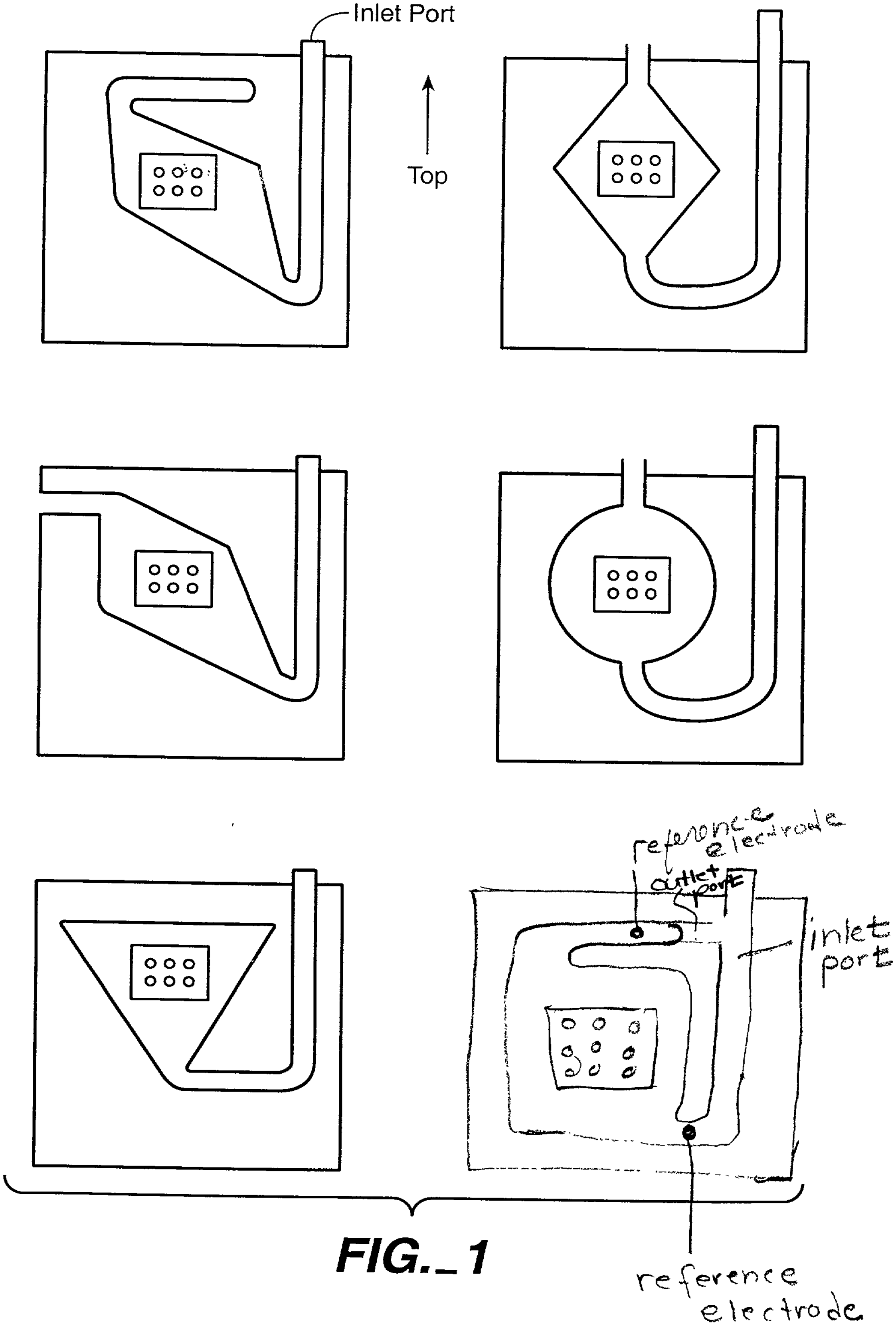

Inlet Port
Top
reference electrode
outlet port
inlet port
reference electrode

FIG._1

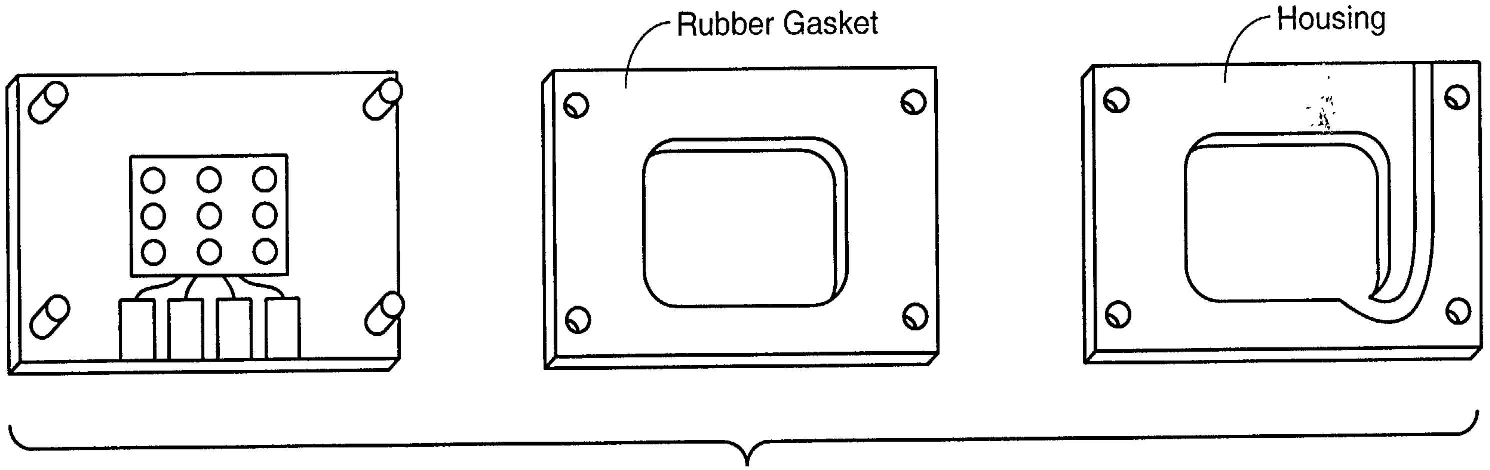


FIG._2

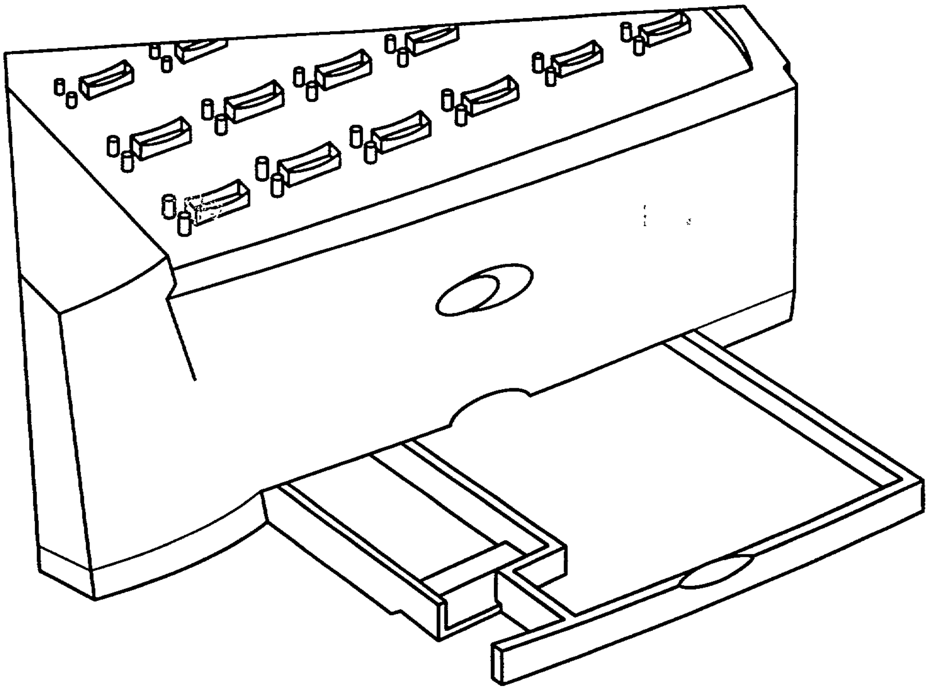


FIG._3A

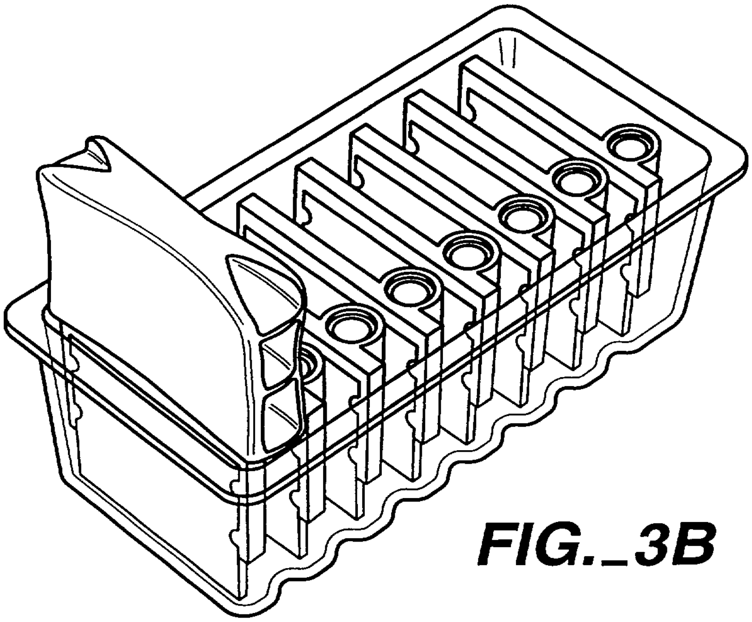


FIG._3B

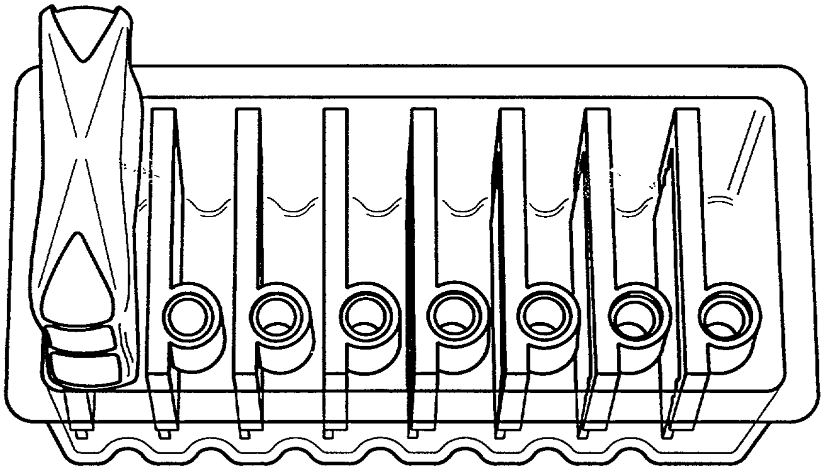


FIG._3C

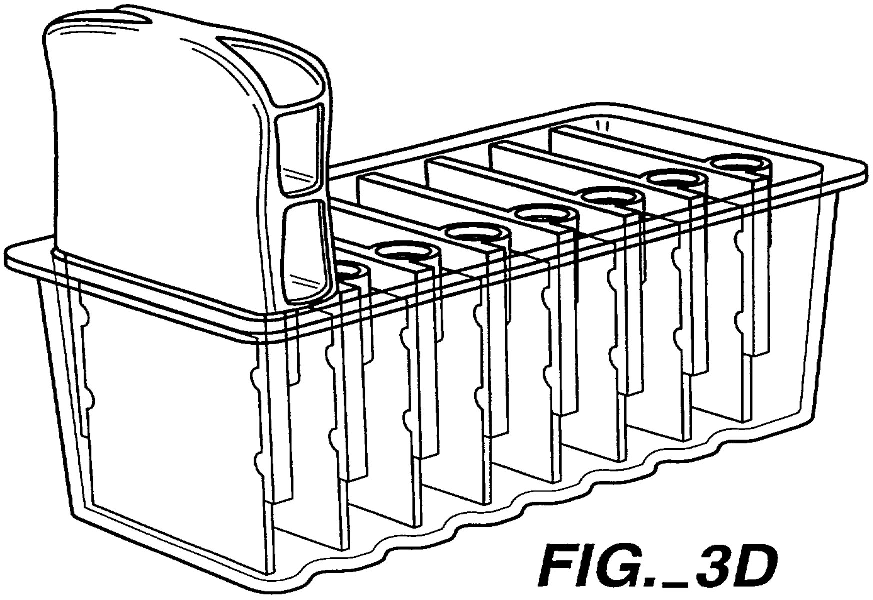


FIG._3D

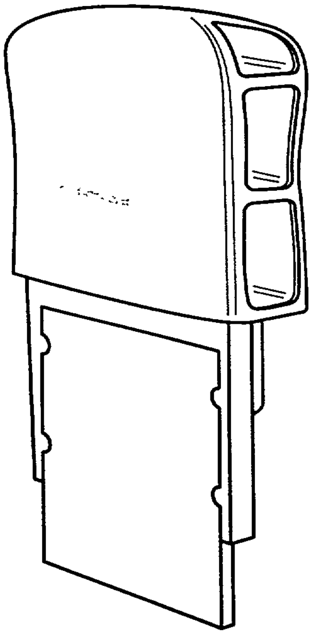


FIG._3E

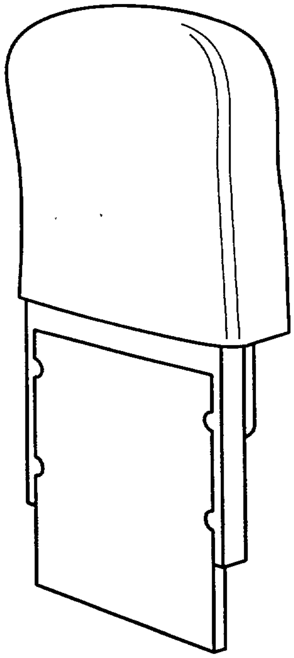


FIG._3F

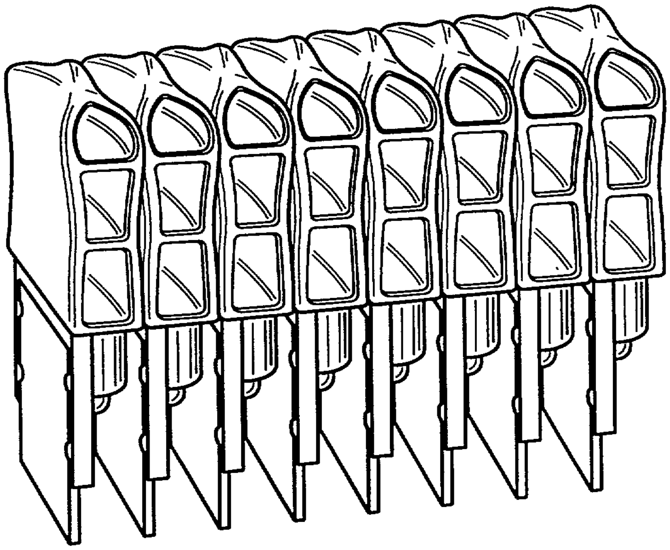


FIG._3G

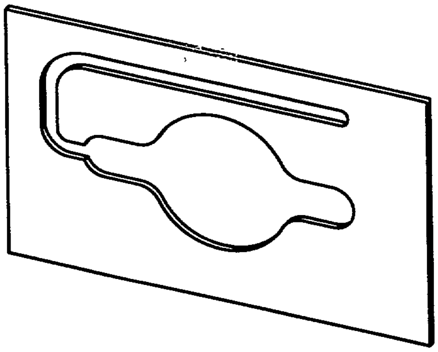


FIG._4A

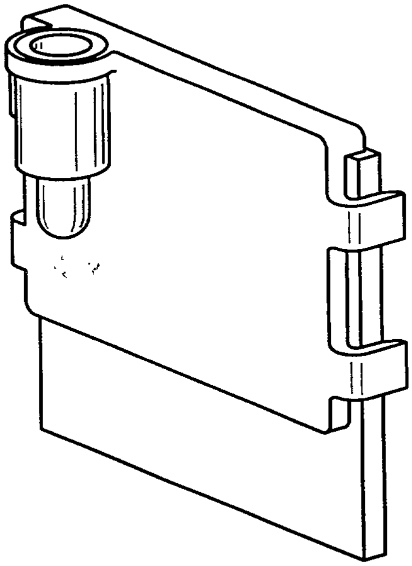


FIG._4B

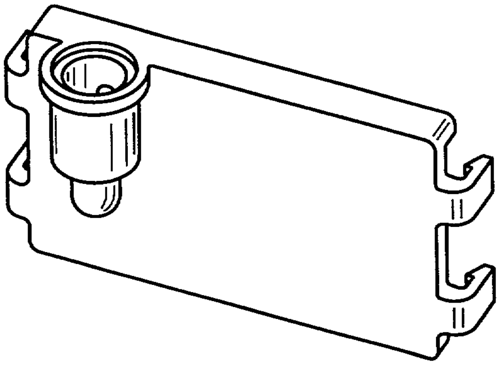


FIG._4C

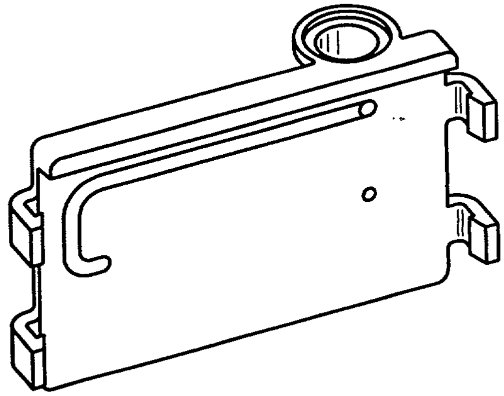


FIG._4D

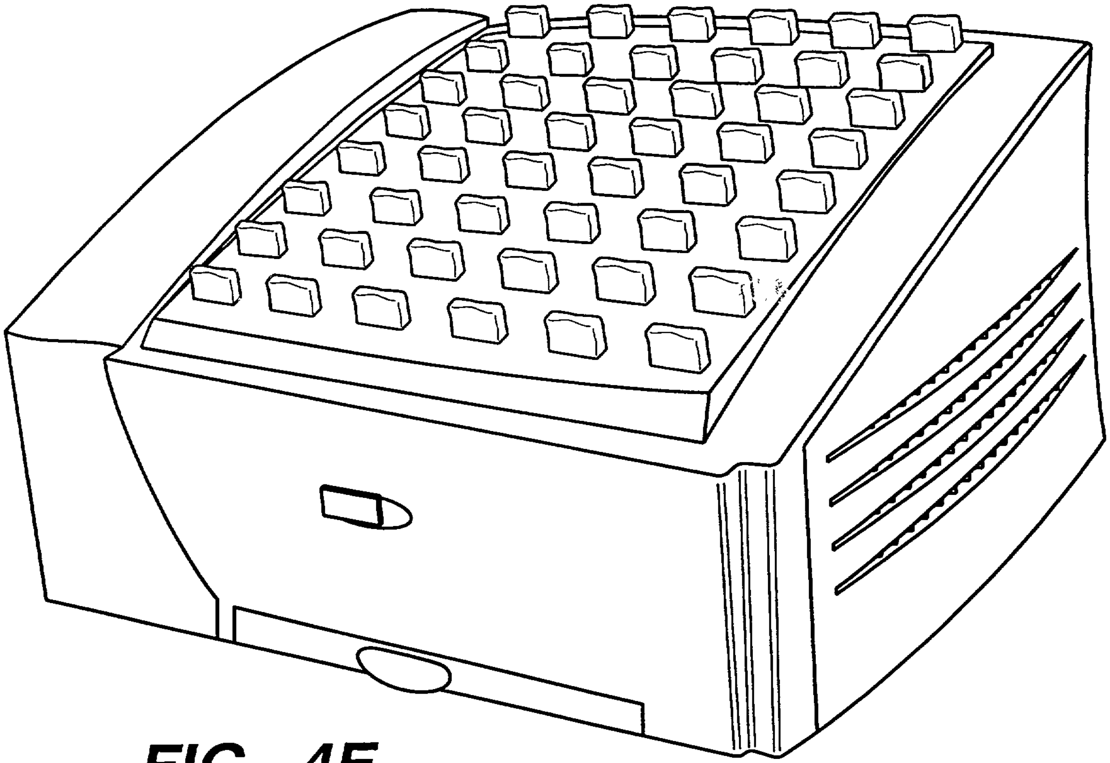


FIG._4E

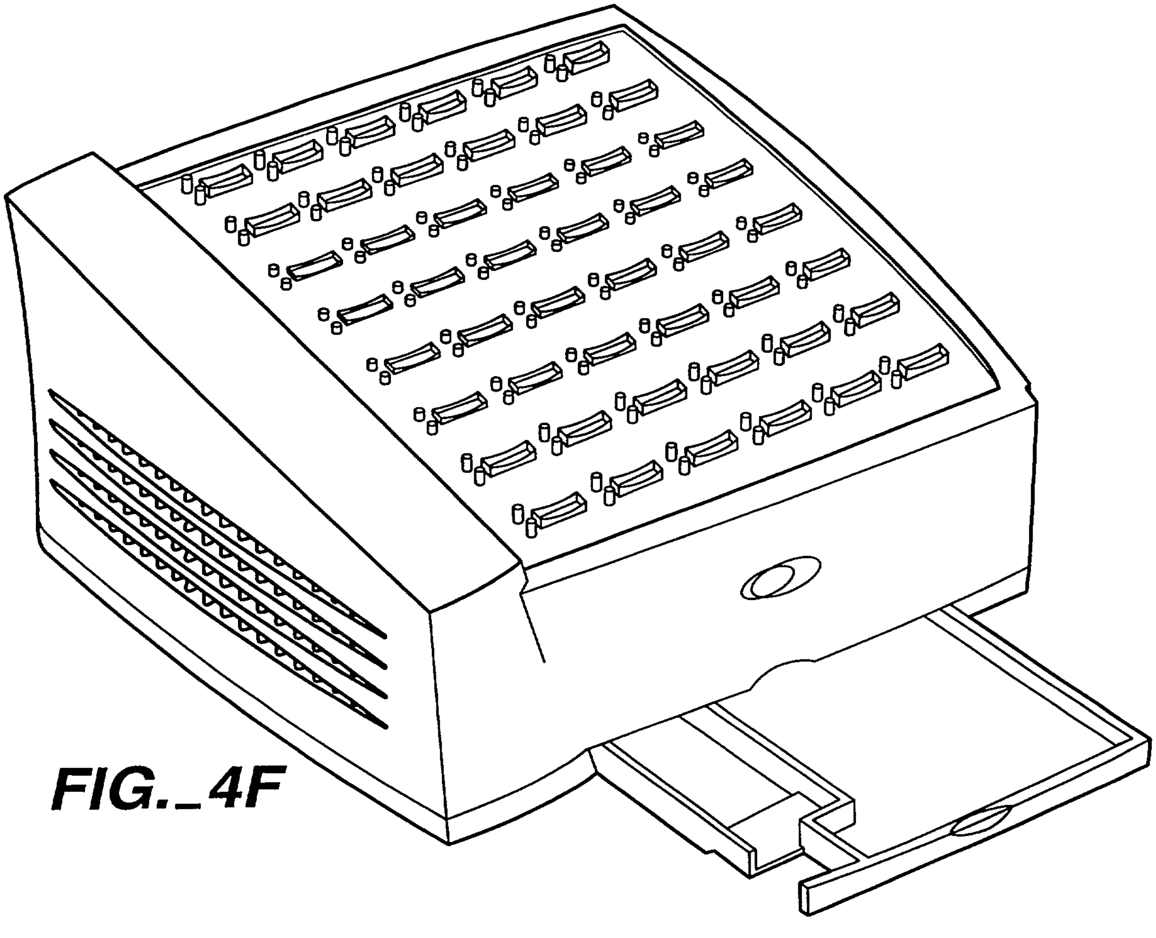
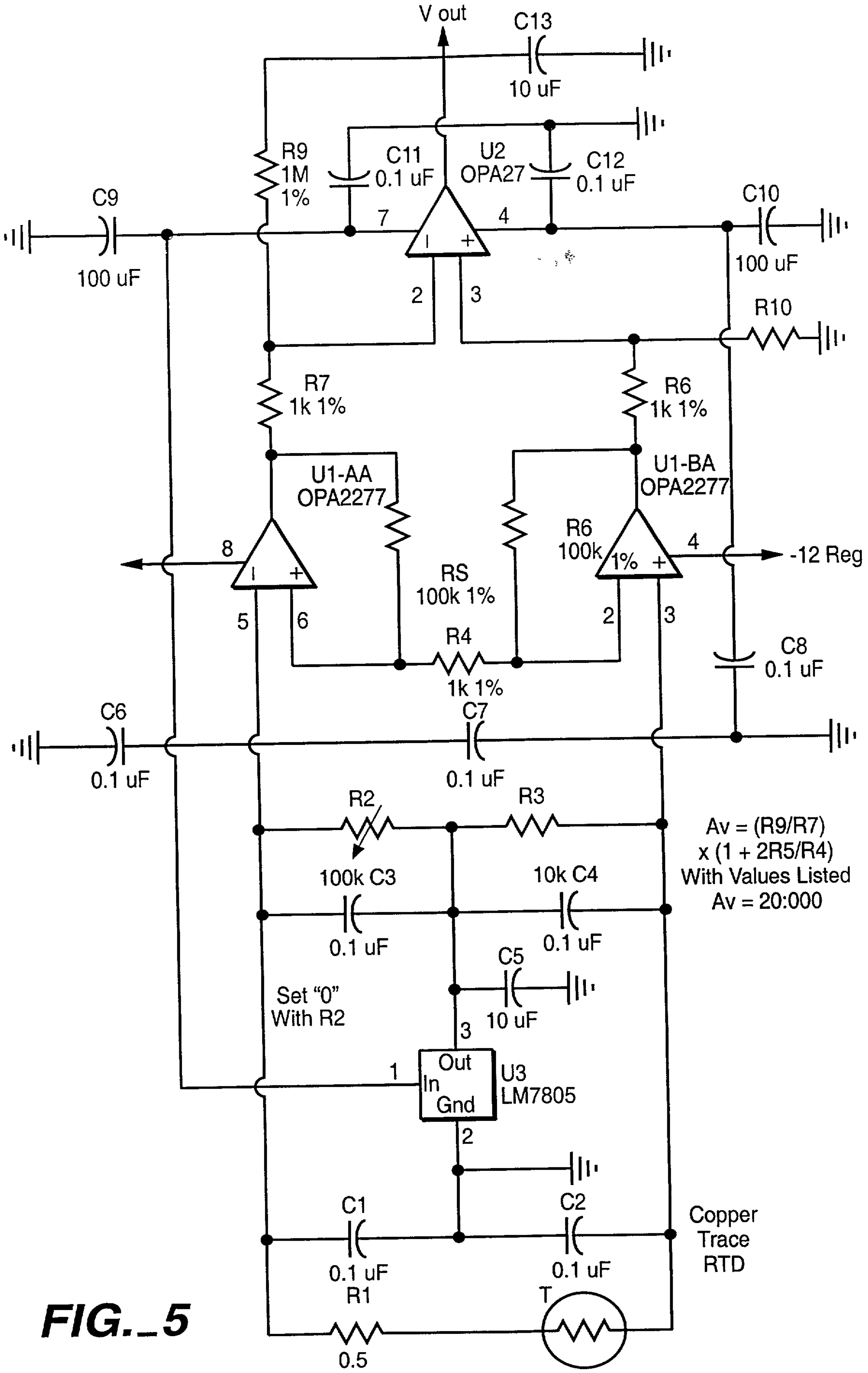
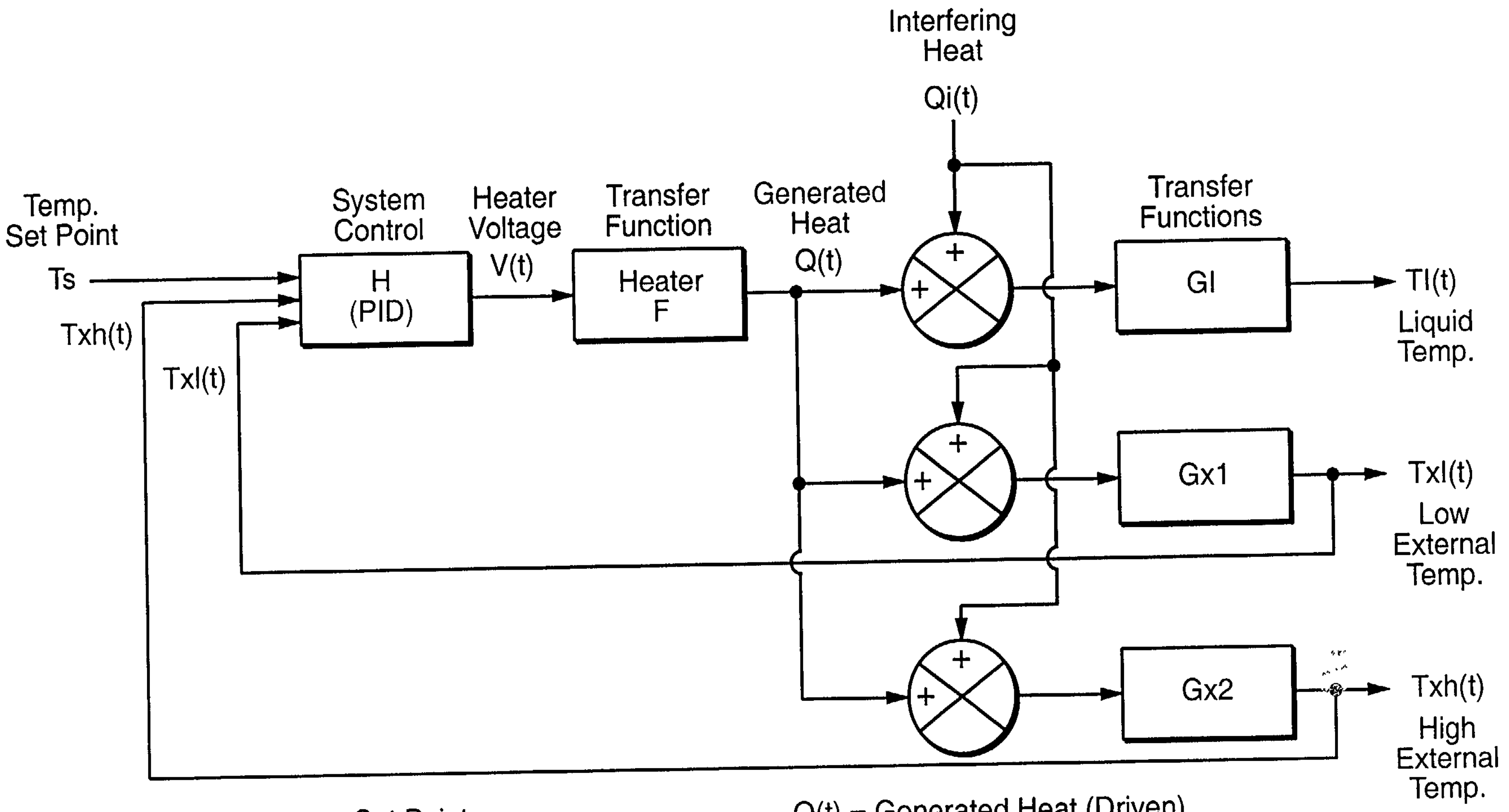


FIG._4F



Av = (R9/R7)
x (1 + 2R5/R4)
With Values Listed
Av = 20:000

FIG._5



Ts = Temperature Set Point
Txi = External Temperature 1, Low (Measured)
Tx2 = External Temperature 2, High (Measured)
Tl = Liquid Temperature (Desired)
V(t) = Heater Voltage (Driven)

Q(t) = Generated Heat (Driven)
Qi(t) = Interfering Heat (Unknown)
F, Gl, Gx1, Gx2 = Transfer Functions (Unknown)
H = System Control Function (tbd)

FIG._6

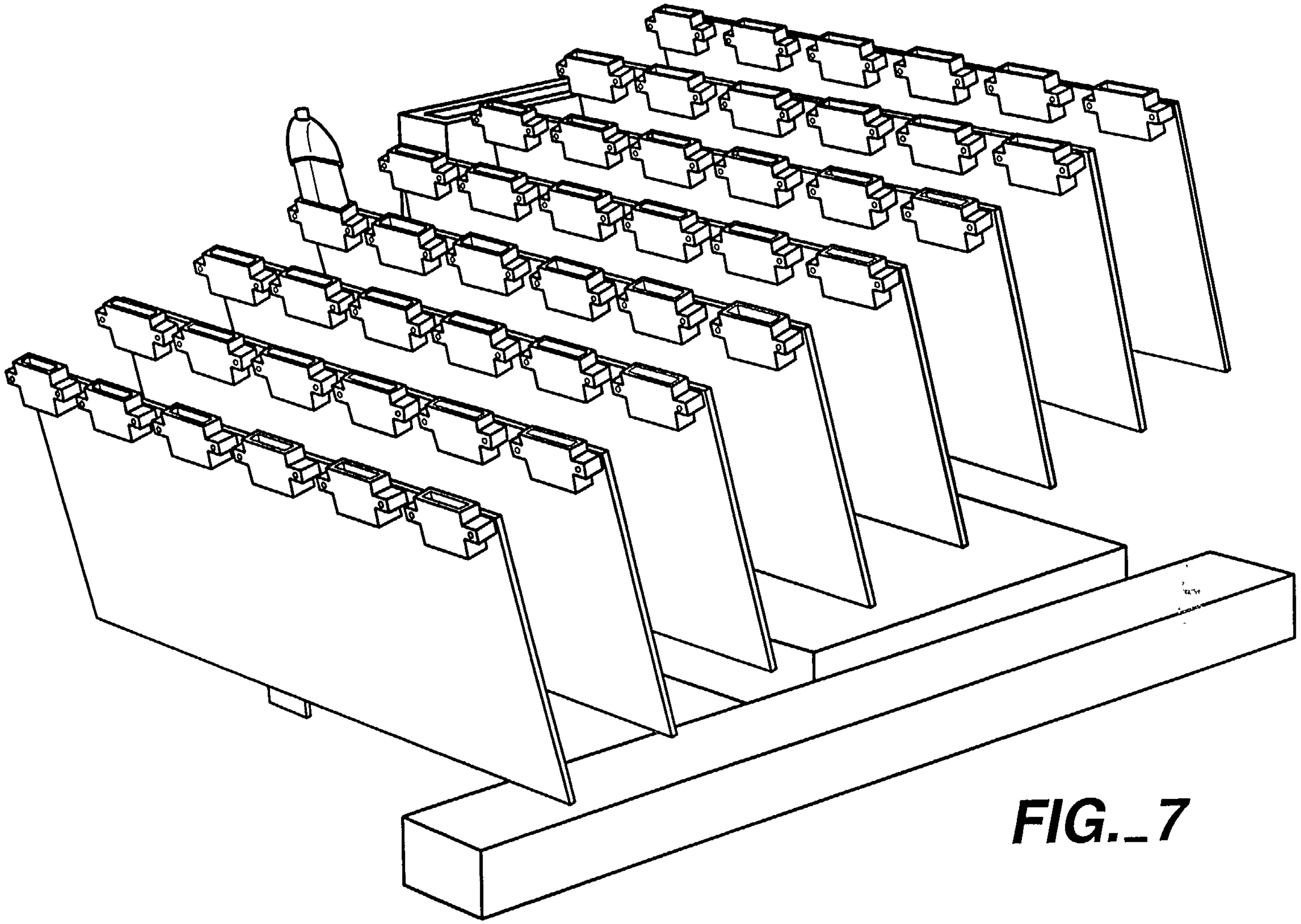
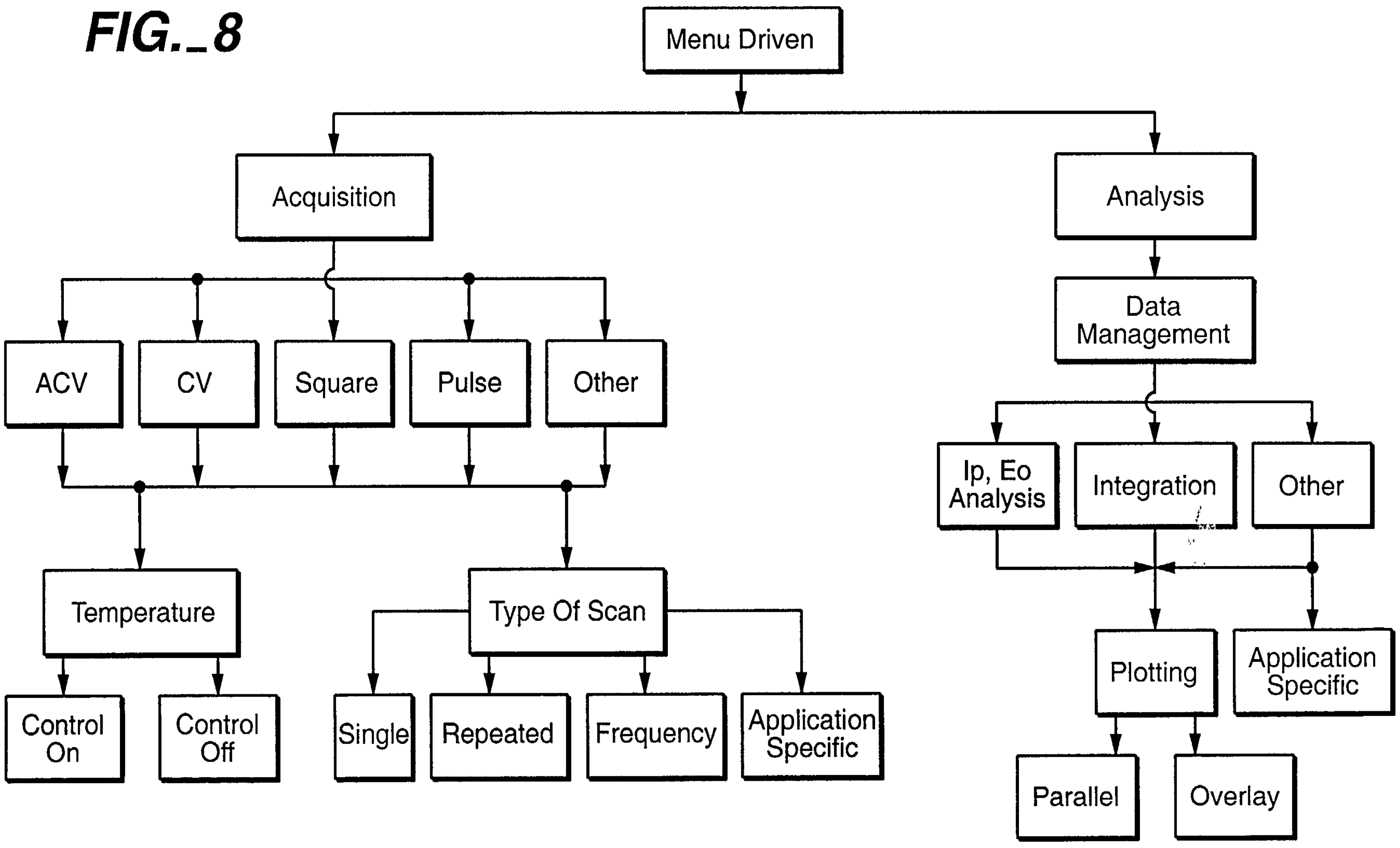


FIG._7

FIG._8


Menu Driven
Acquisition
Analysis
ACV
CV
Square
Pulse
Other
Data Management
Ip, Eo Analysis
Integration
Other
Temperature
Type Of Scan
Control On
Control Off
Single
Repeated
Frequency
Application Specific
Plotting
Application Specific
Parallel
Overlay

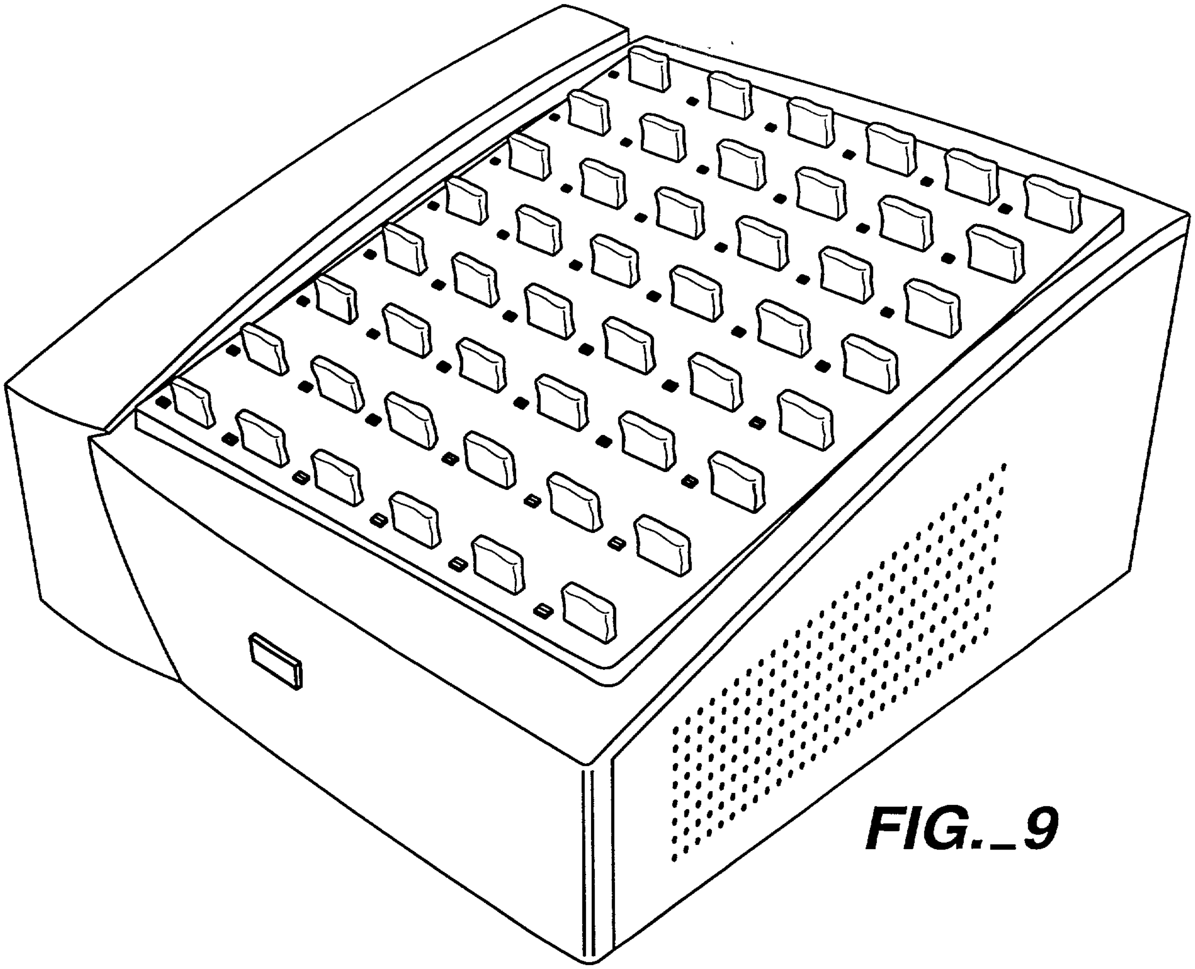


FIG._9

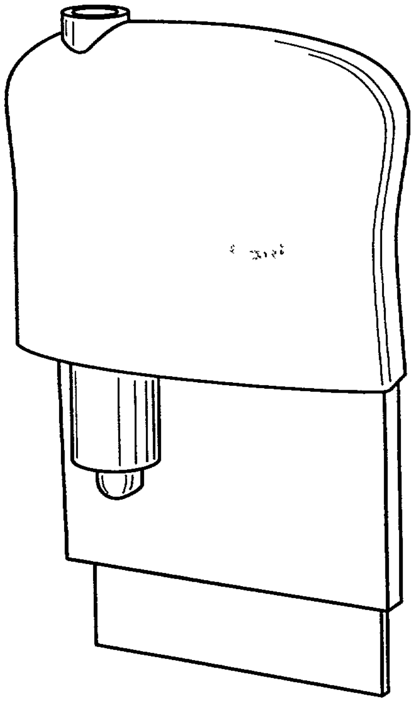


FIG._10A

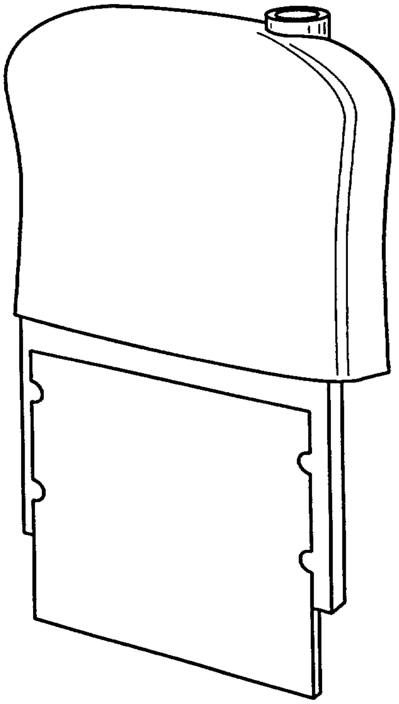


FIG._10B

- Bar coded “reference” sheet, stored in tray under unit, with bar coded protocols, bar coded well and slot id’s, bar coded commands (e.g. “cancel”, “done”, etc.)
- Standard bar code wand (preferably with built-in decoder), housed in the tray (hence hidden when not in use)
- Serial (RS-232/485) interface (preferred), or “keyboard wedge”
- Multi-code support (Code 39, Code 128, etc.)
- Bar code on chip carrier (1 code per “8 pack”), identifying test, batch, etc.
    - Peel off labels, with same code as on carrier, with each “8 pack”

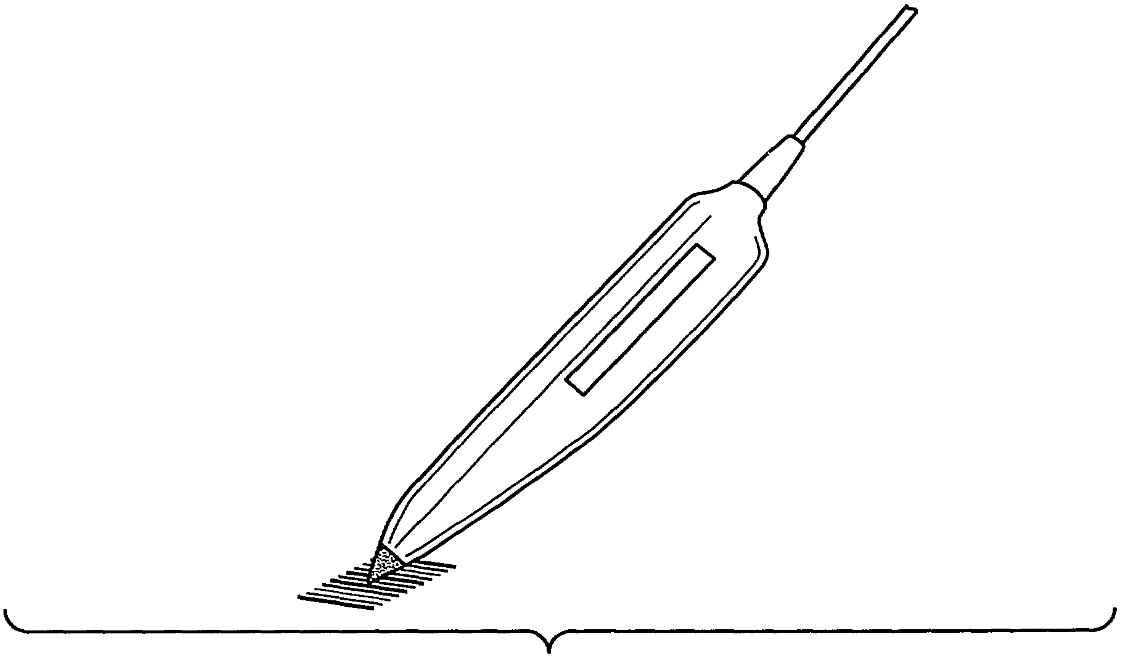


FIG._11

- Bar code usage scenario
  - User fills "8-pack" (all 8, or partially) from a 96 well plate, or from individual sample containers (PCR tubes, vaccutainers, etc.)
  - Pull out tray (with bar code reference sheet) and grab wand
  - Scan "start" code
  - Scan protocol code from sheet (will remain in effect until "done" is scanned)
  - Scan chip code from carrier (will remain in effect until "done" is scanned)
  - For each cartridge, user will
    - insert the cartridge in an open slot. Unit senses new chip automatically
    - scan the sample ID by either
      - scanning 96 well plate bar code from plate and well code from sheet
      - or scanning unique sample ID from container
      - or scanning "no ID" from reference sheet
  - Scan "done" code. The protocol can' now be started on these cartridges

FIG._12

- Bar code concept benefits
  - No keyboard entry (all-routine setup can be entered via bar coding)
  - All routine entries accomplished while in front of unit (no going back & forth between PC & Hydra)
  - All bar code entries done from small, flat surface in front of unit
  - No need to label each chip or each slot (which would compromise appearance)
  - Uses small unobtrusive bar code wand, hidden when not in use
  - Is flexible with respect to sample container (tube, 96 well plate, etc.), chip usage (by row of 8, or by individual chip), and lab bar coding method

FIG._13

FIG._14A

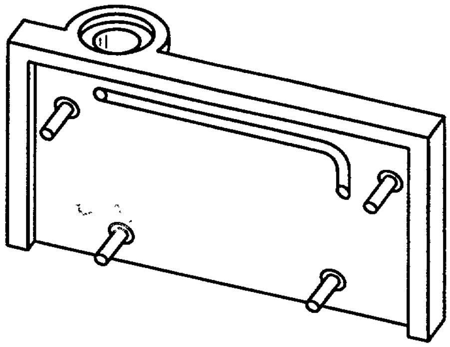


FIG._14B

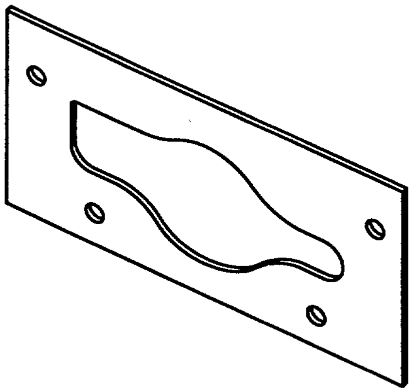


FIG._14C

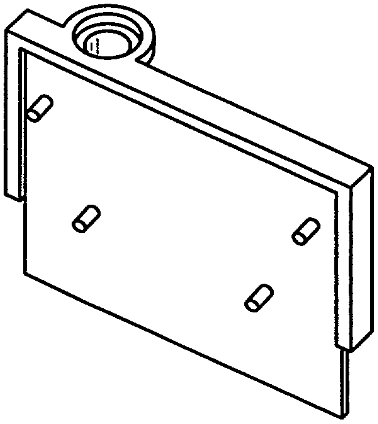
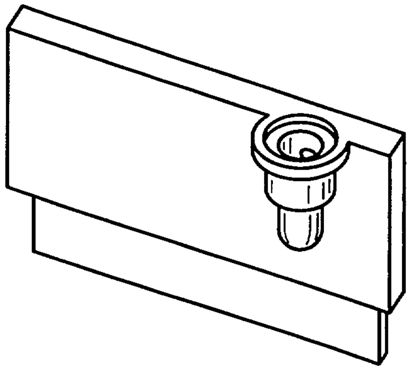


FIG._14D



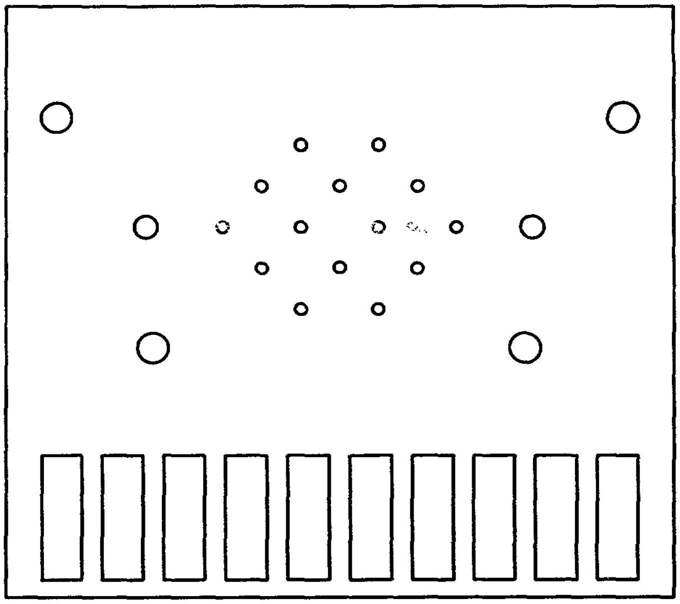


FIG._14E

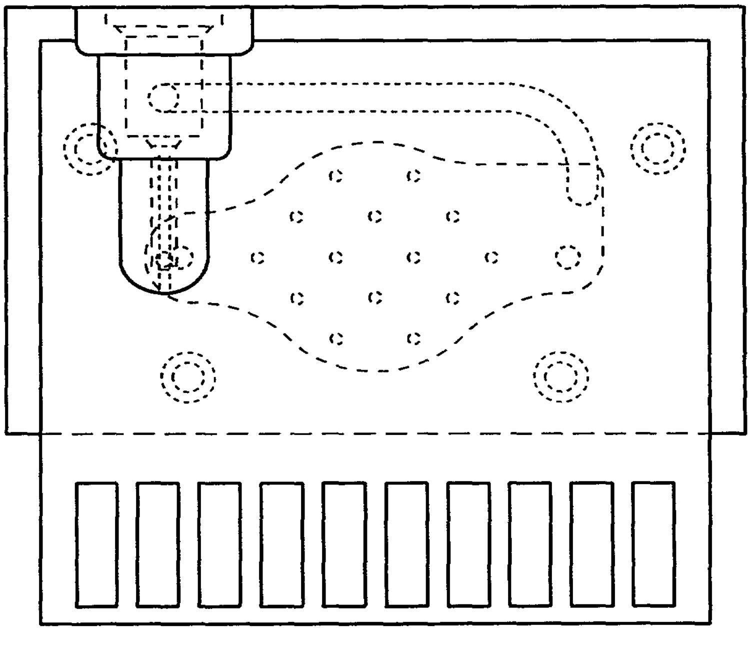


FIG._14F

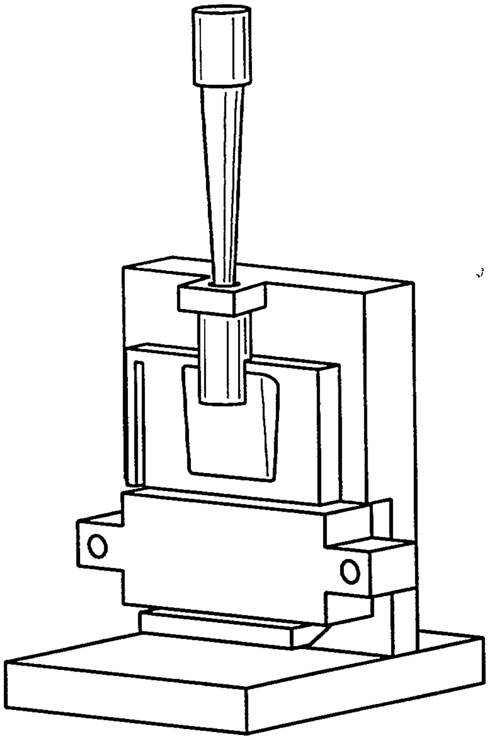


FIG._15A

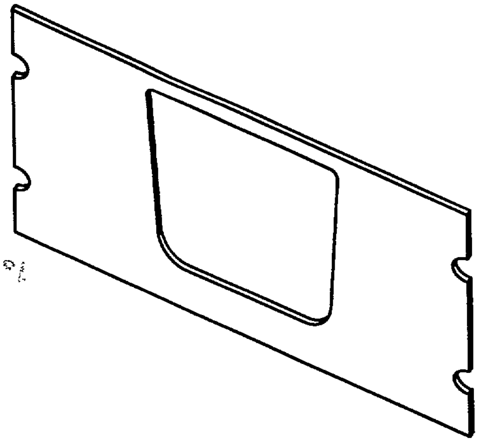


FIG._15B

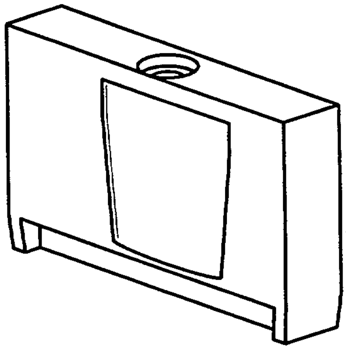


FIG._15C

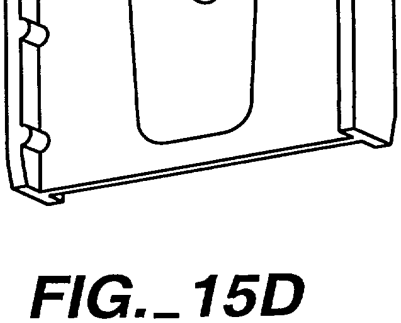


FIG._15D

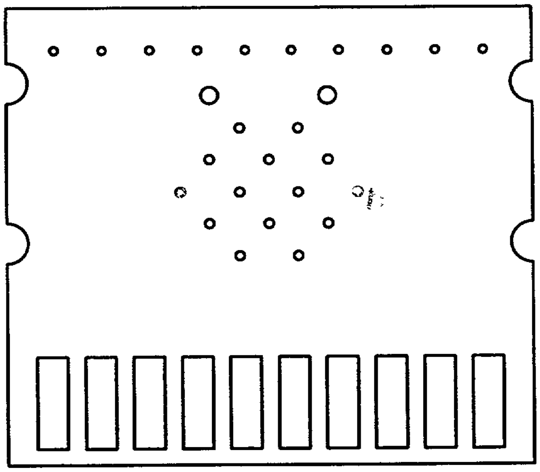


FIG._15E

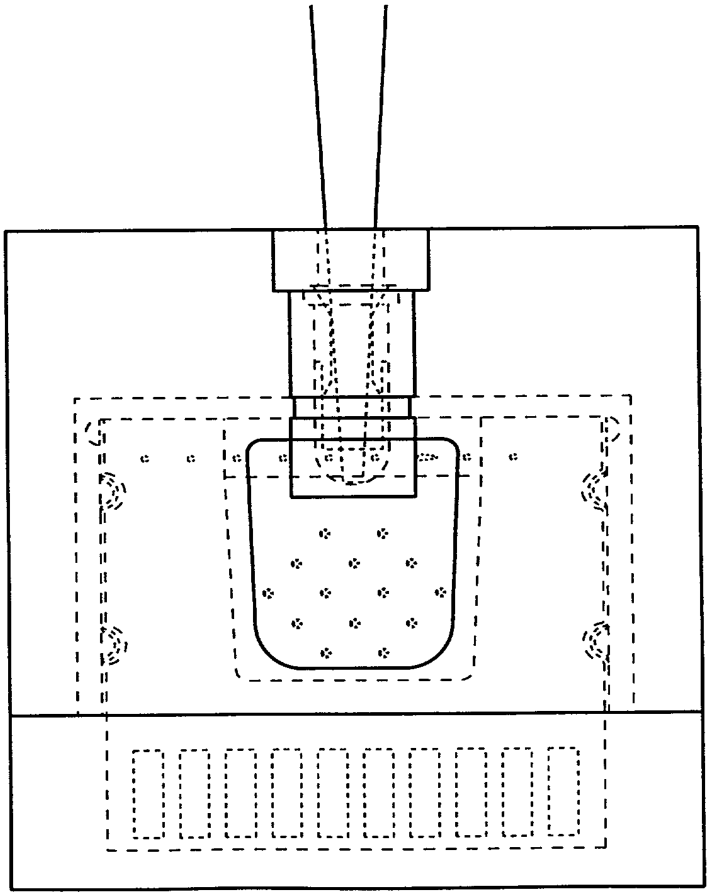


FIG._15F

A Sine Wave And Its Corresponding Vector Notation

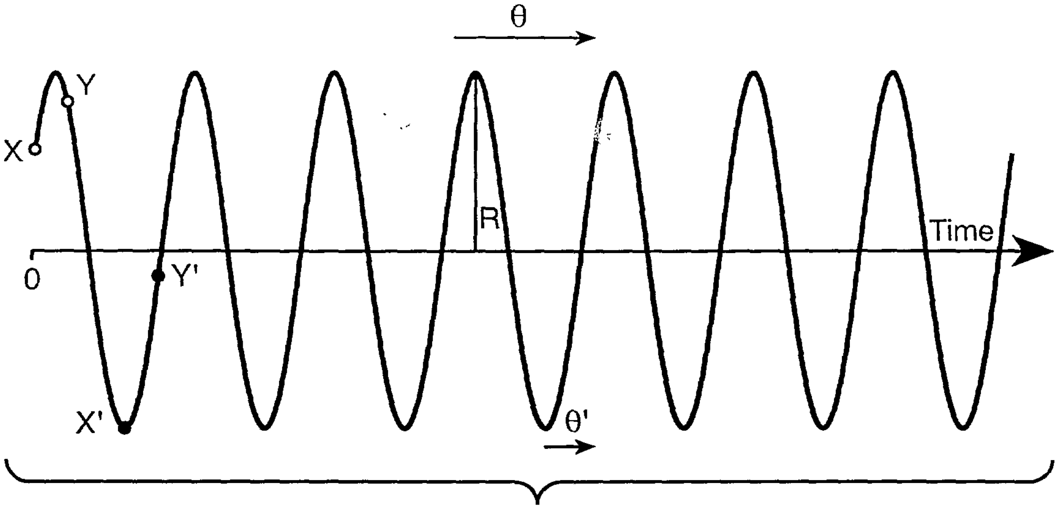


FIG._16

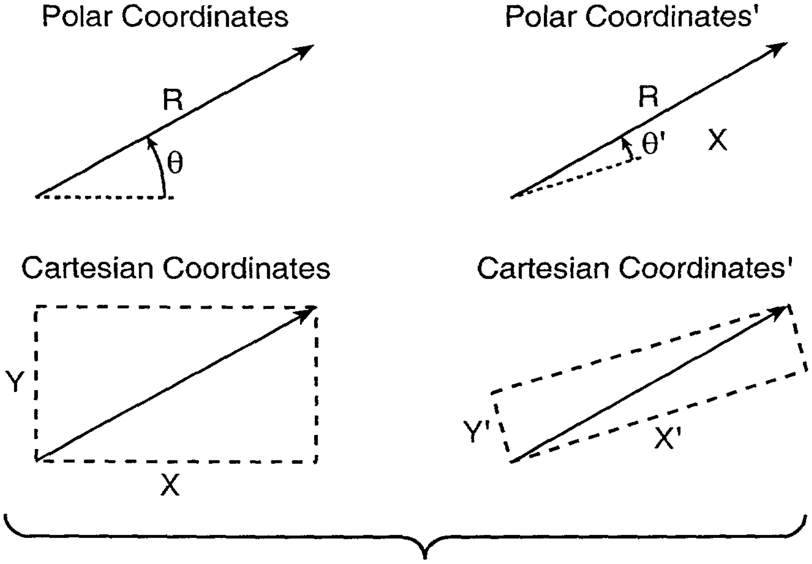


FIG._17

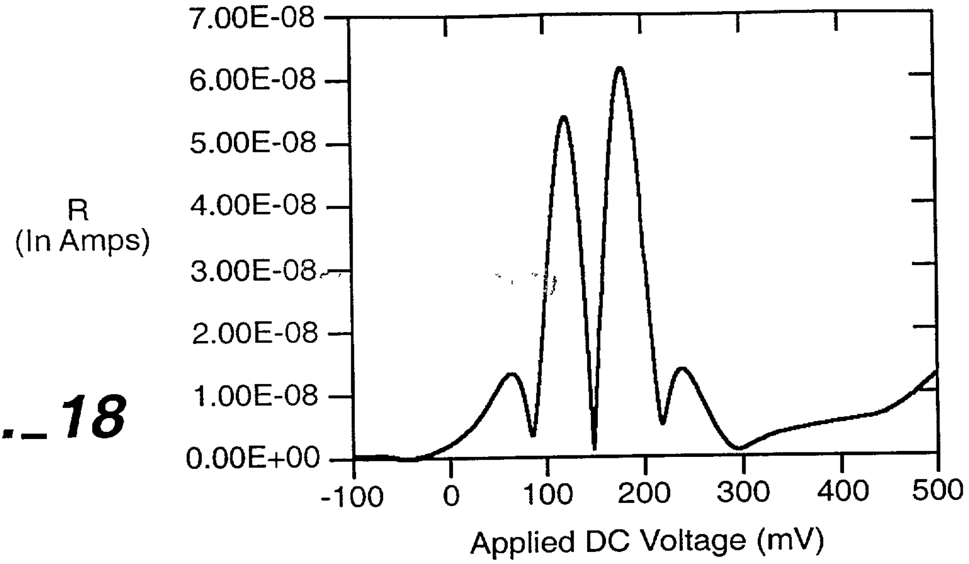


FIG._18

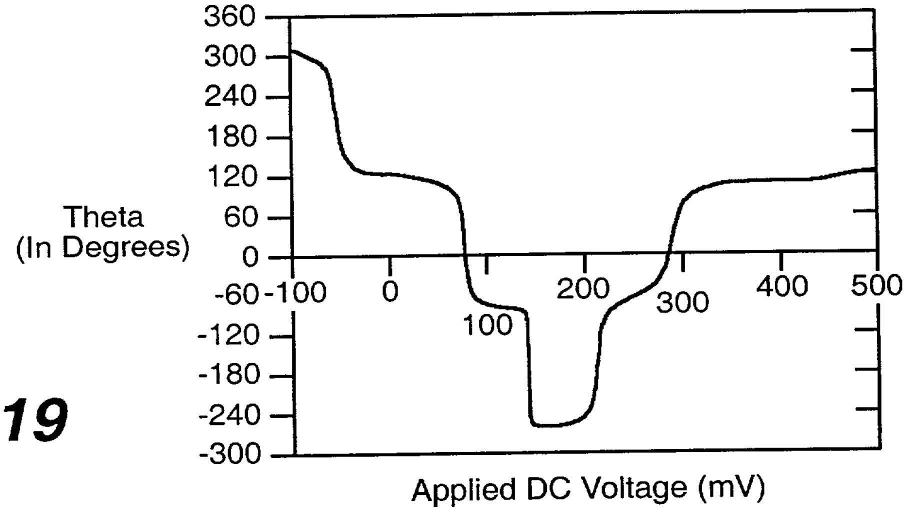


FIG._19

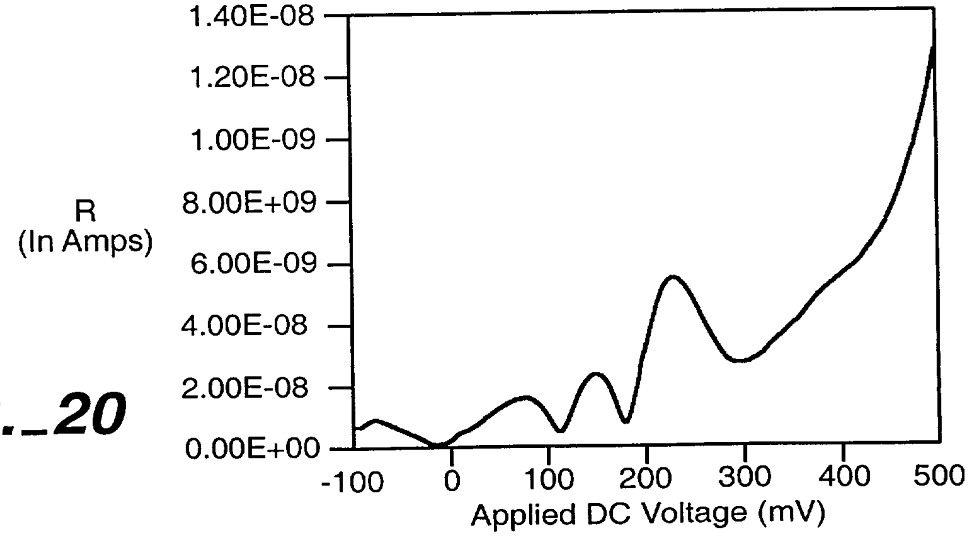


FIG._20

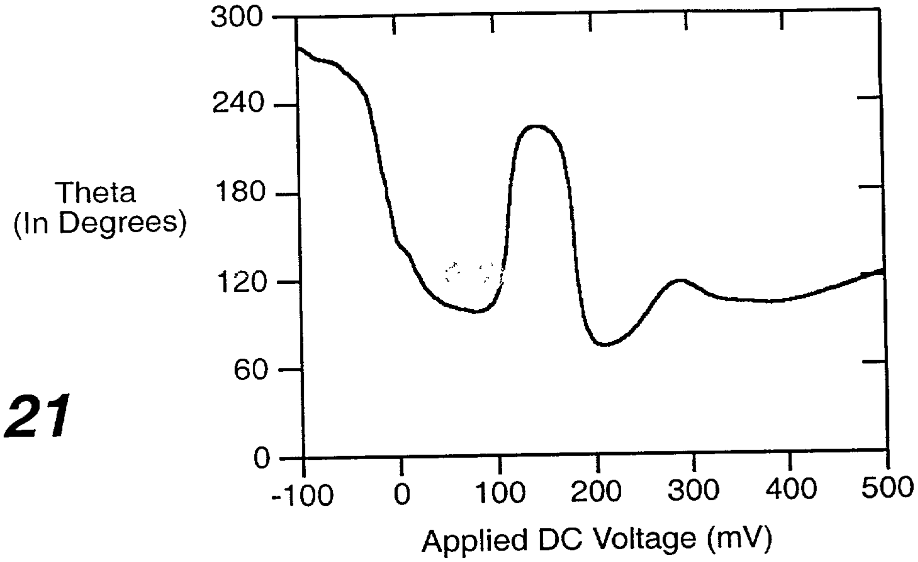


FIG._21

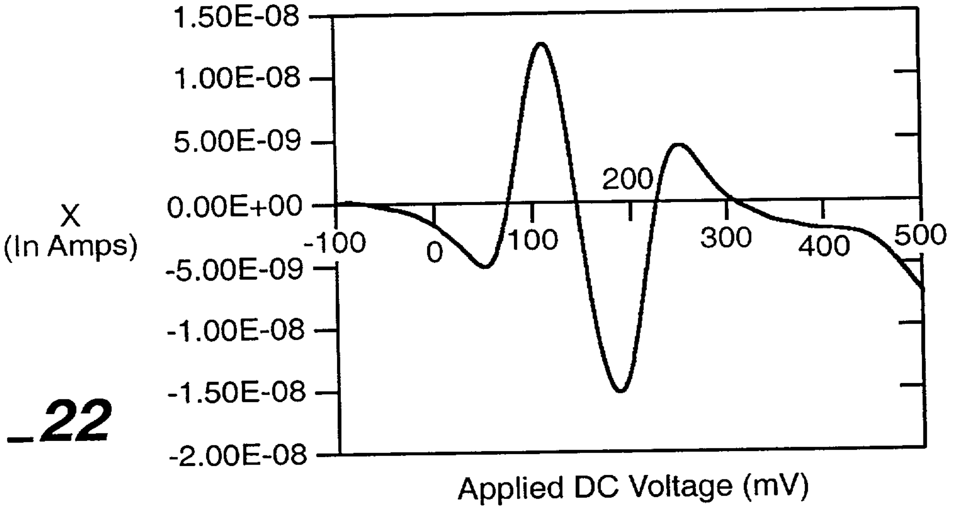


FIG._22

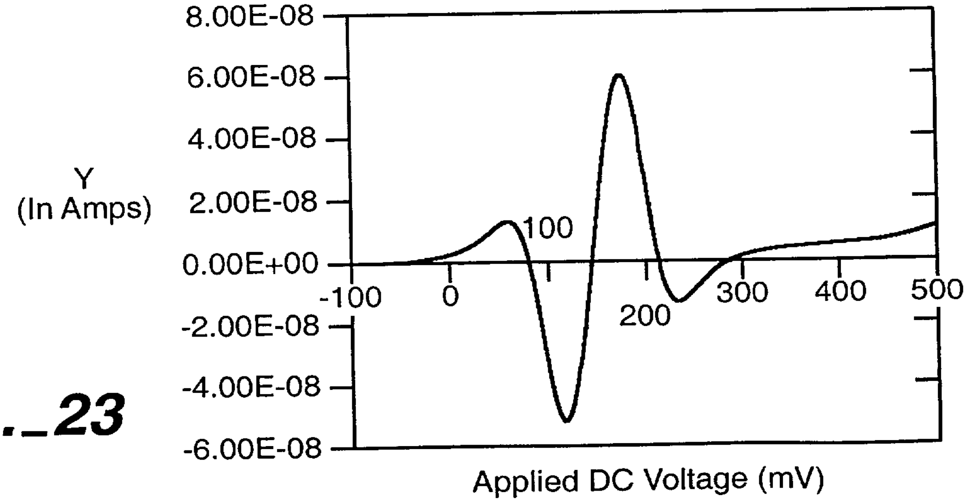


FIG._23

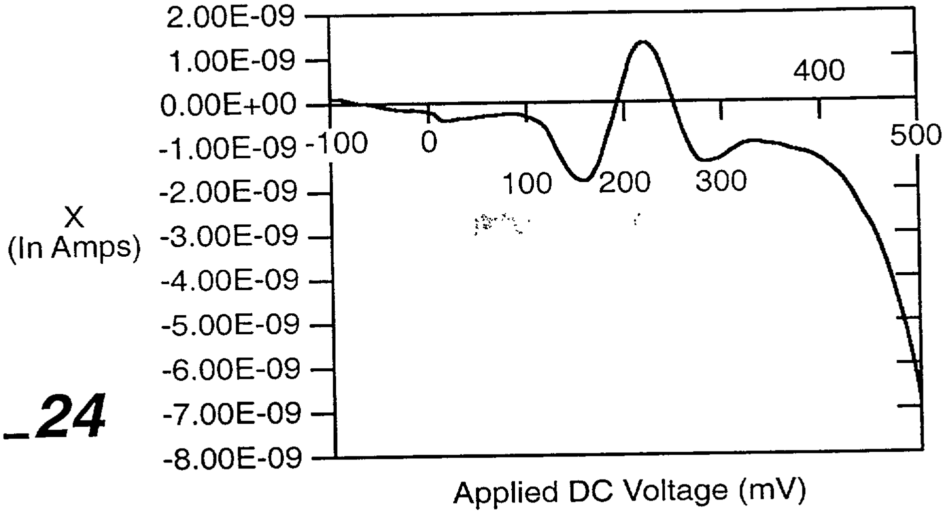

2.00E-09
1.00E-09
0.00E+00
-1.00E-09
-2.00E-09
-3.00E-09
-4.00E-09
-5.00E-09
-6.00E-09
-7.00E-09
-8.00E-09
X
(In Amps)
-100
0
100
200
300
400
500
Applied DC Voltage (mV)

FIG._24

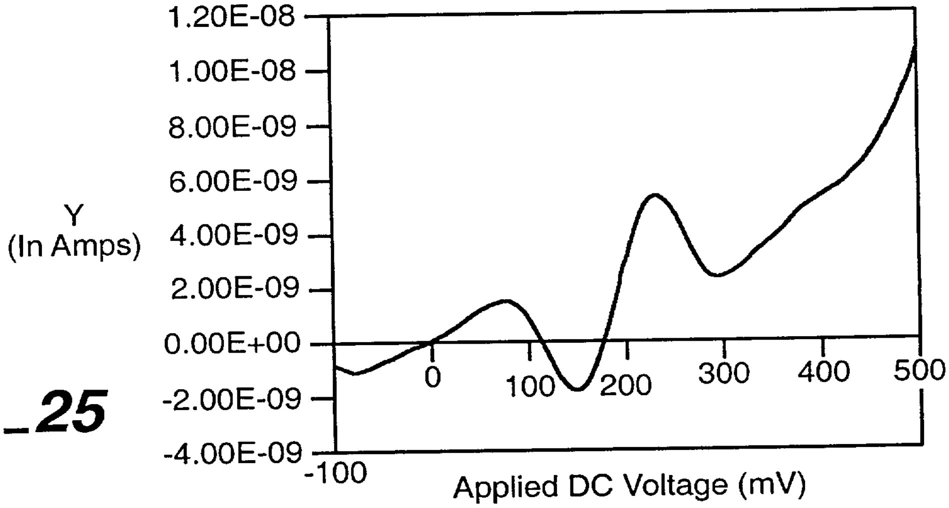

1.20E-08
1.00E-08
8.00E-09
6.00E-09
4.00E-09
2.00E-09
0.00E+00
-2.00E-09
-4.00E-09
Y
(In Amps)
-100
0
100
200
300
400
500
Applied DC Voltage (mV)

FIG._25

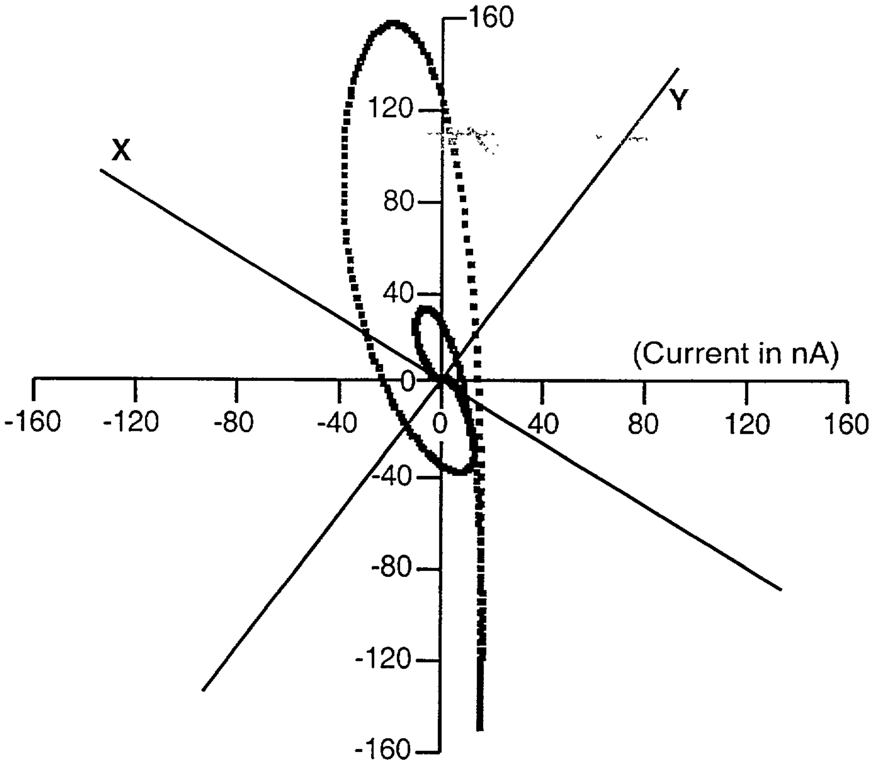

160
120
80
40
0
-40
-80
-120
-160
X
Y
(Current in nA)
-160
-120
-80
-40
0
40
80
120
160

FIG._26

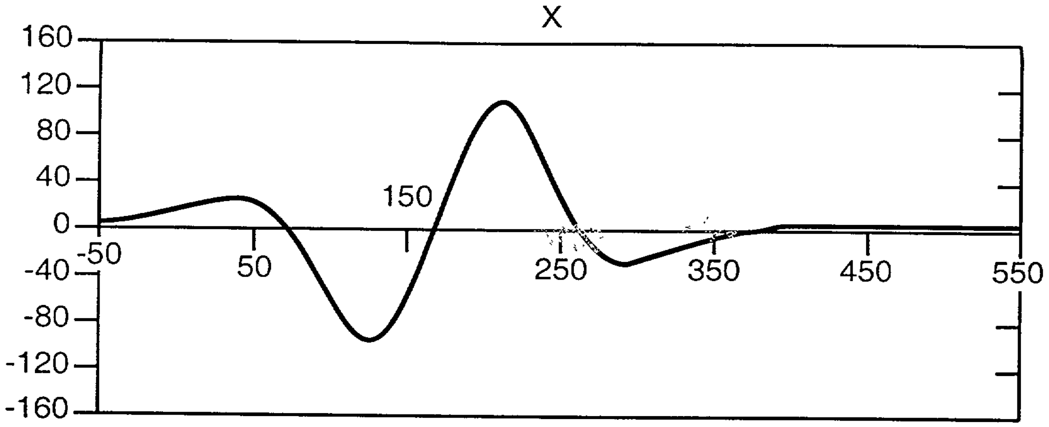


FIG._27

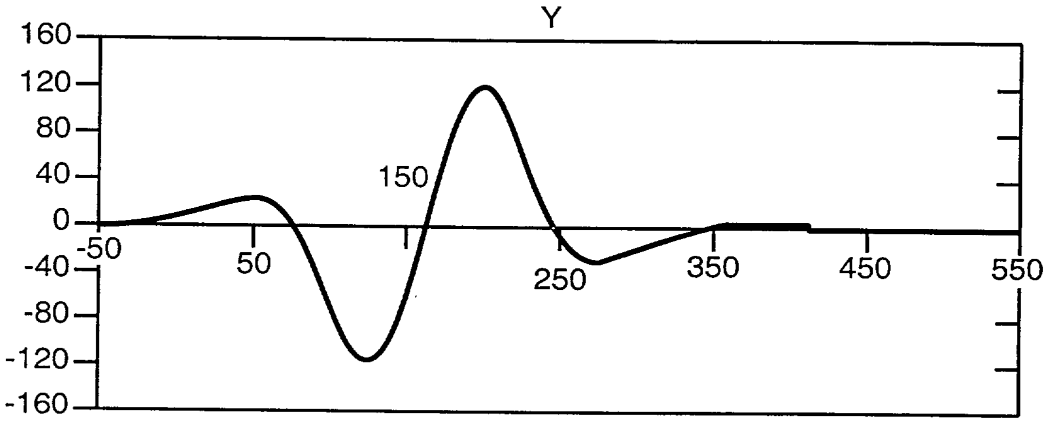


FIG._28

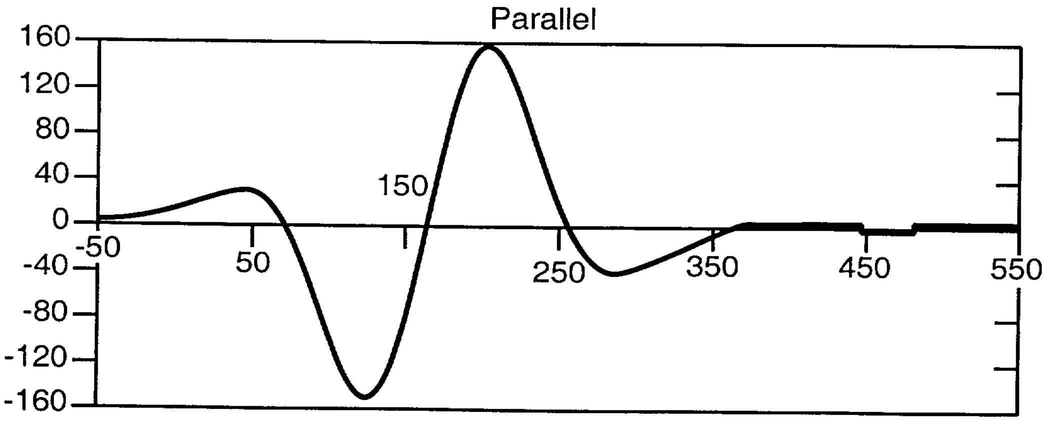


FIG._29

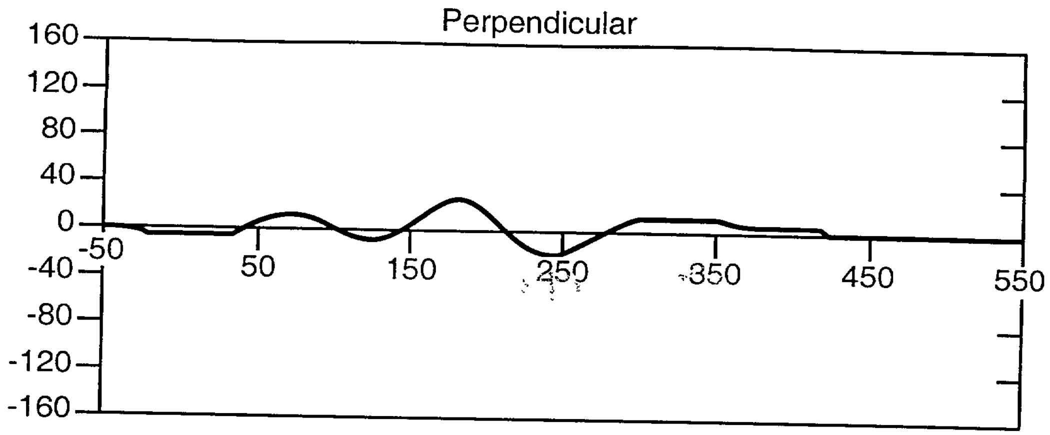


FIG._30

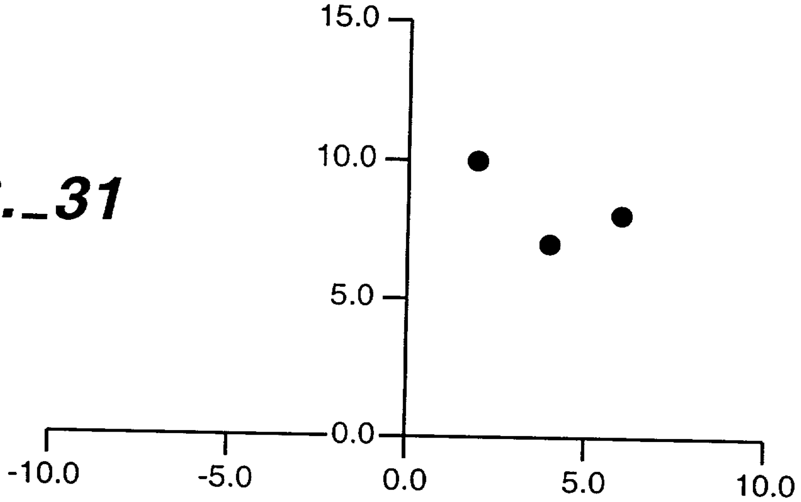


FIG._31

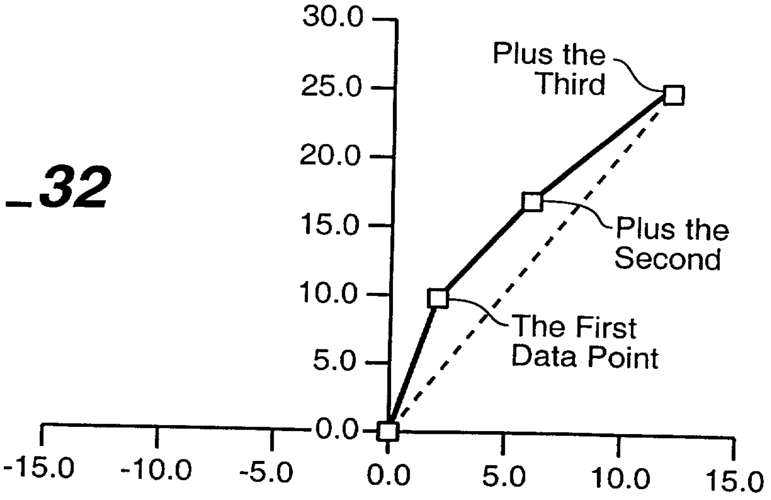


FIG._32

FIG._33

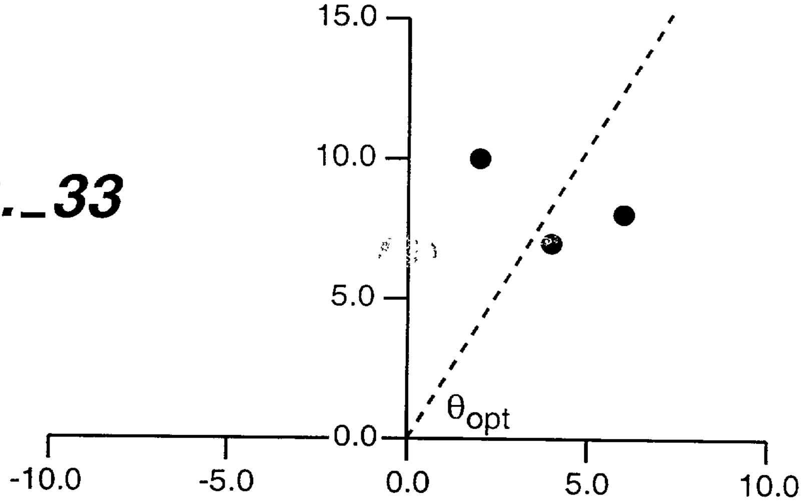


FIG._34

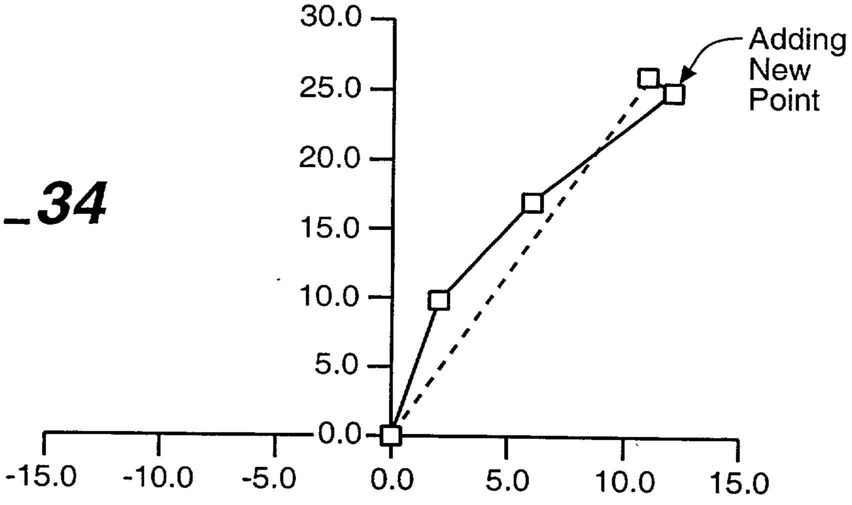
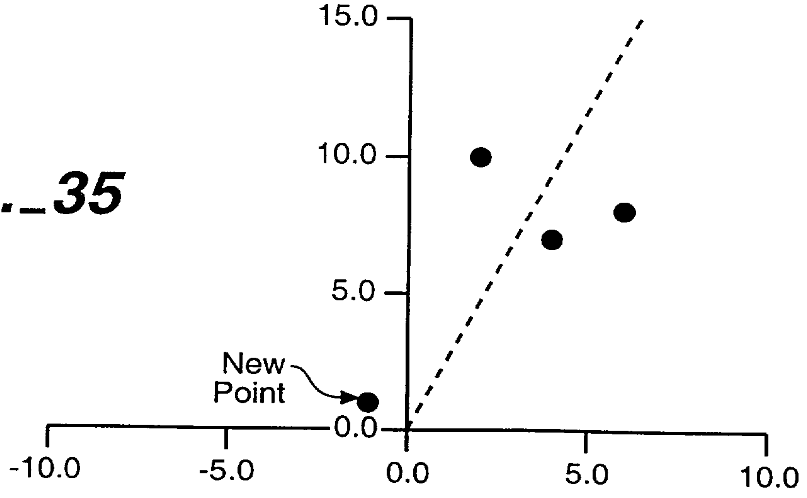


FIG._35



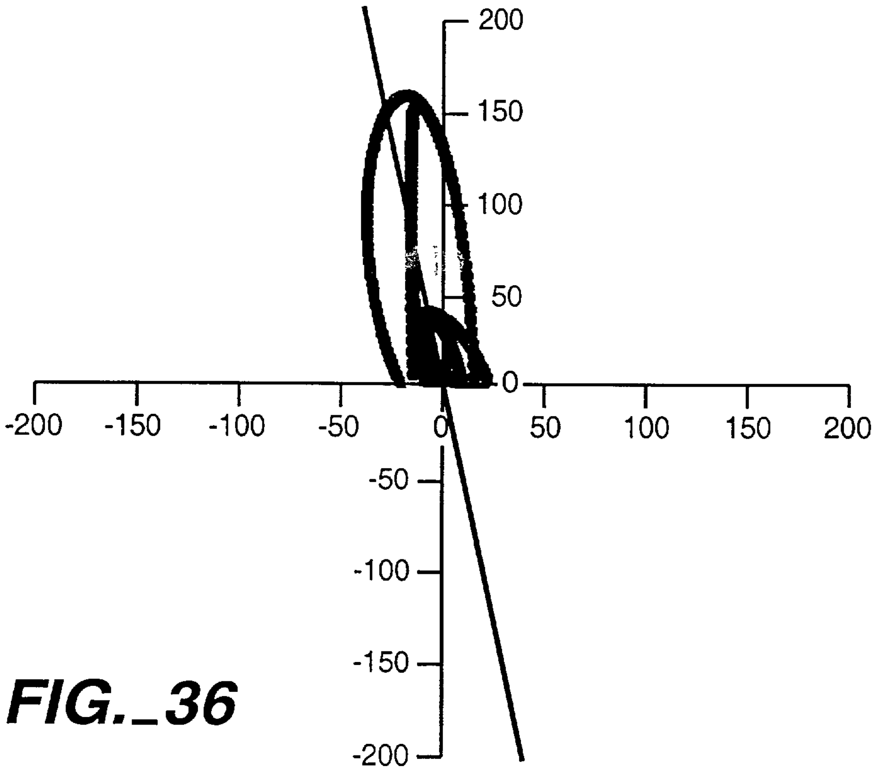

200
150
100
50
0
-50
-100
-150
-200
-200
-150
-100
-50
0
50
100
150
200

FIG._36

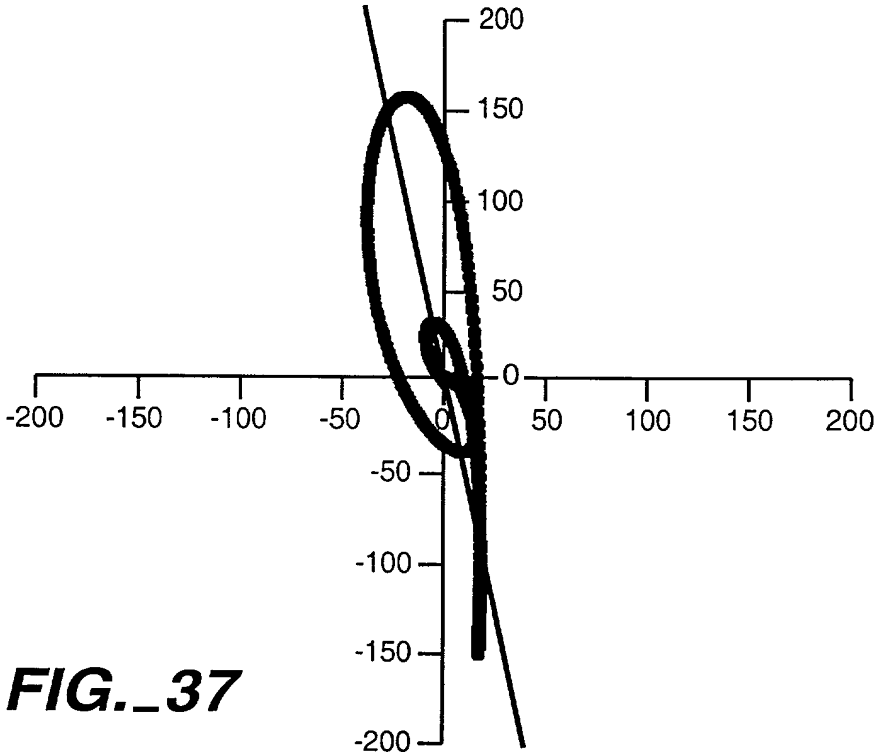

200
150
100
50
0
-50
-100
-150
-200
-200
-150
-100
-50
0
50
100
150
200

FIG._37

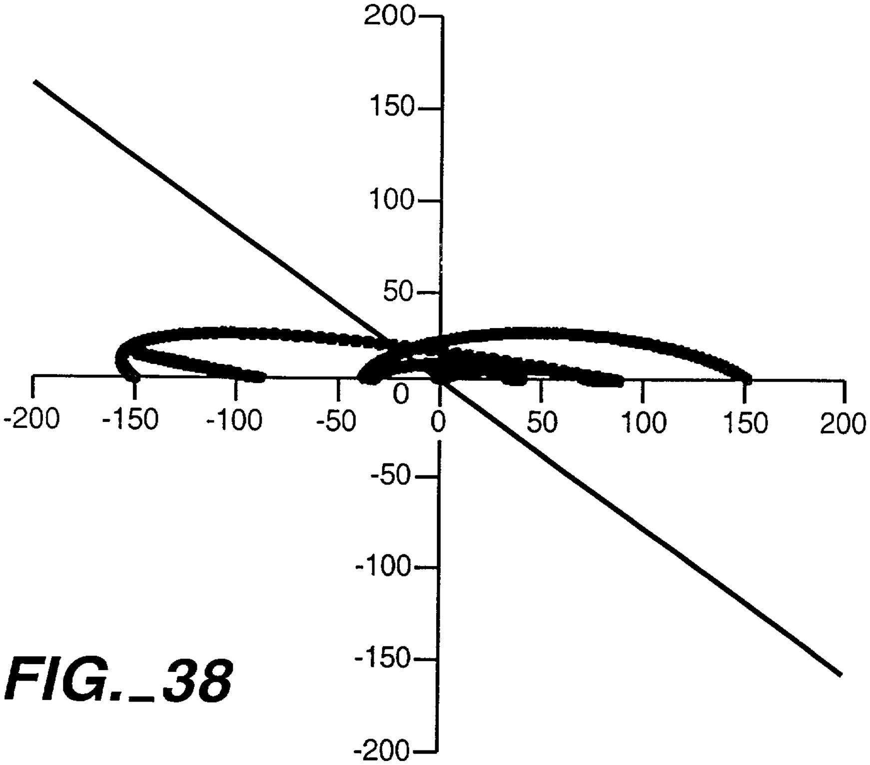

200
150
100
50
0
-50
-100
-150
-200
-200
-150
-100
-50
0
50
100
150
200

FIG._38

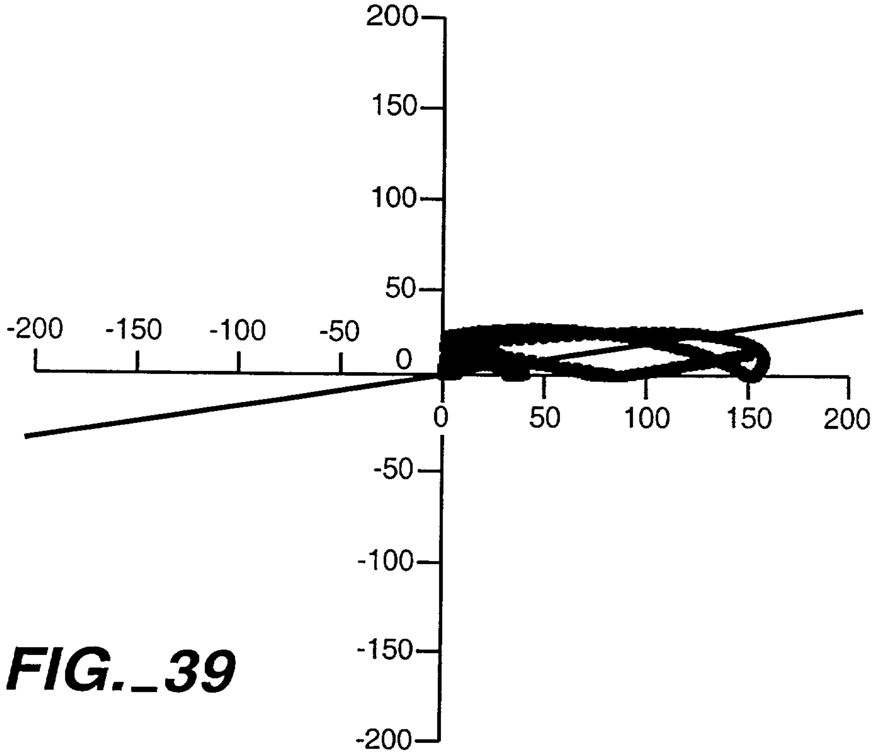

200
150
100
50
0
-50
-100
-150
-200
-200
-150
-100
-50
0
50
100
150
200

FIG._39

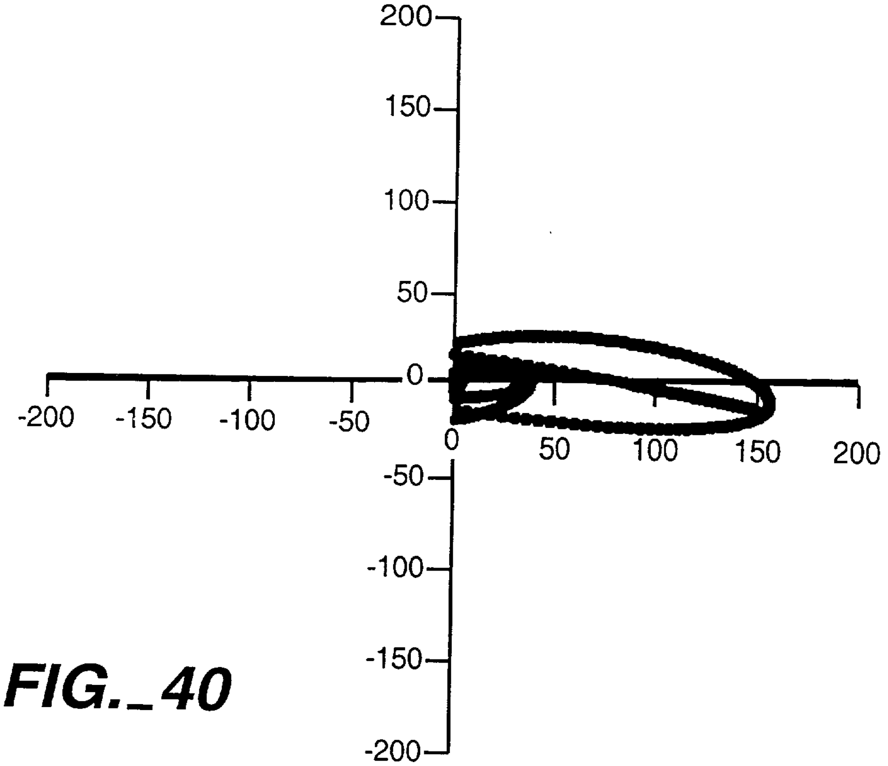

200
150
100
50
0
-50
-100
-150
-200
-200
-150
-100
-50
0
50
100
150
200

FIG._40

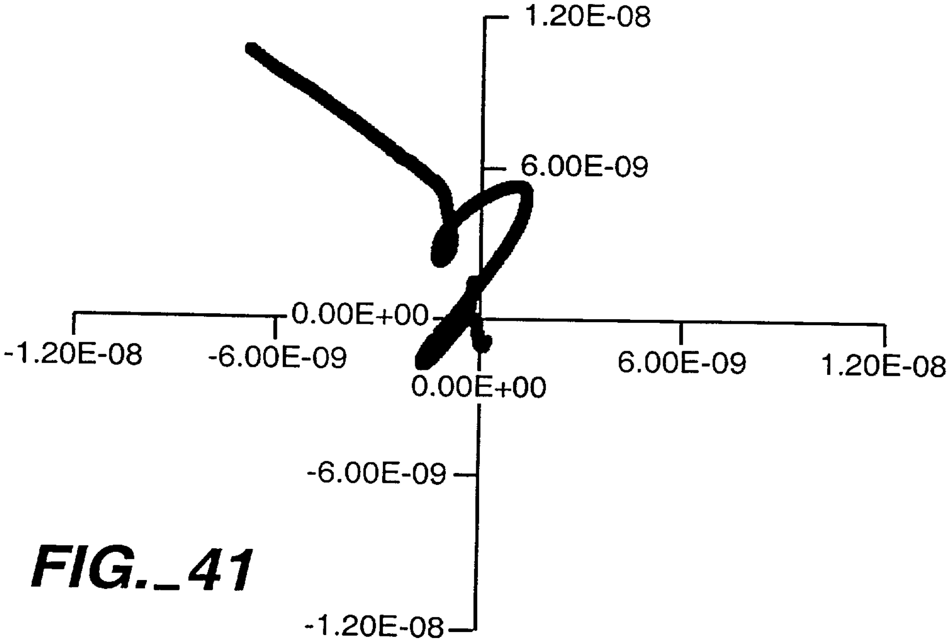

1.20E-08
6.00E-09
0.00E+00
-6.00E-09
-1.20E-08
-1.20E-08
-6.00E-09
0.00E+00
6.00E-09
1.20E-08

FIG._41

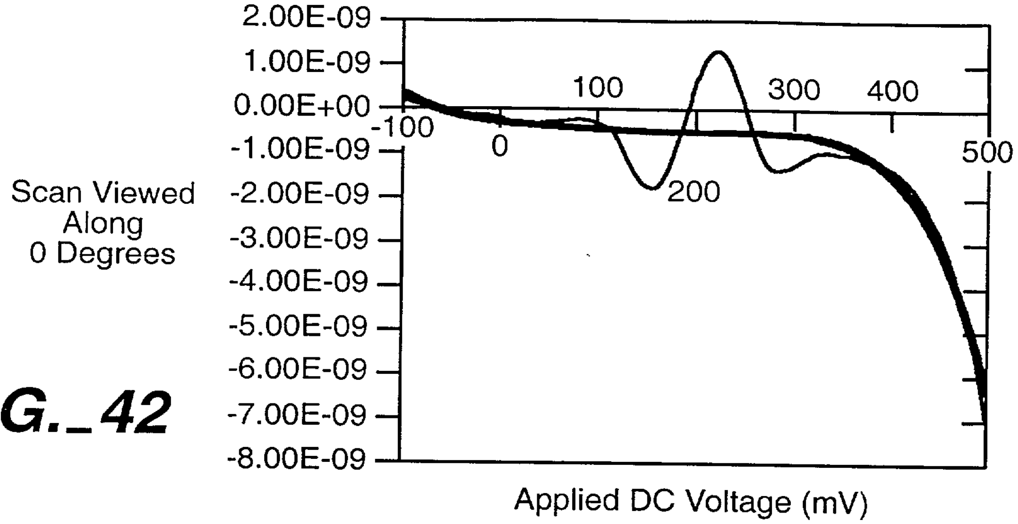


FIG._42

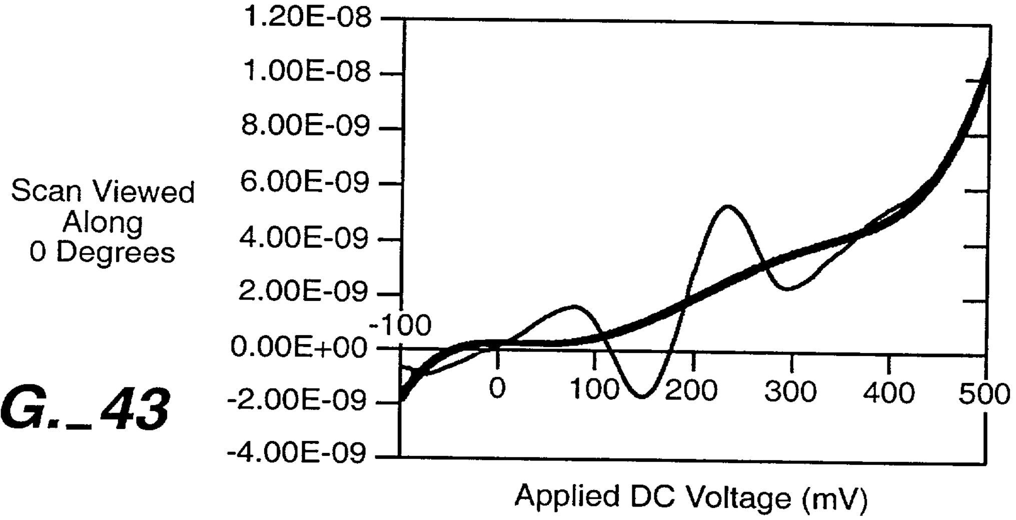


FIG._43

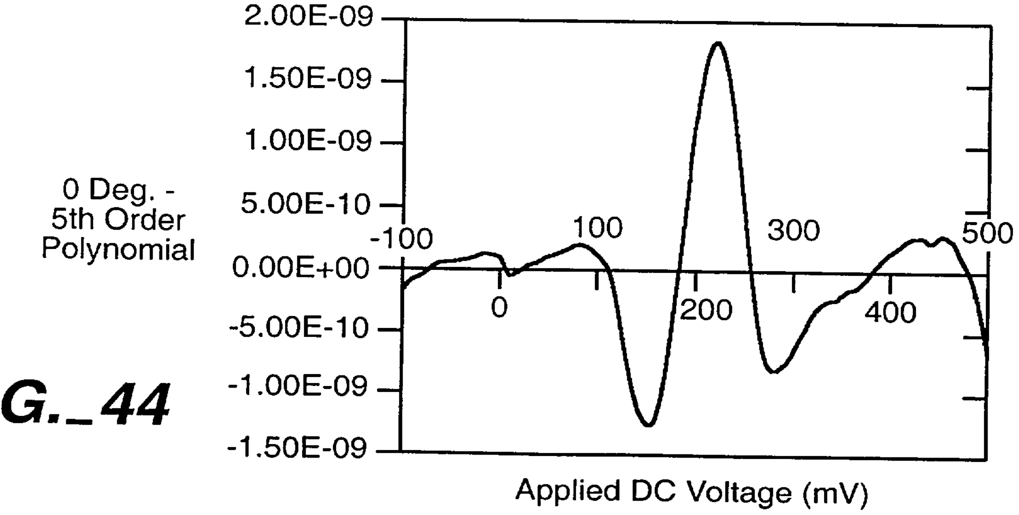


FIG._44

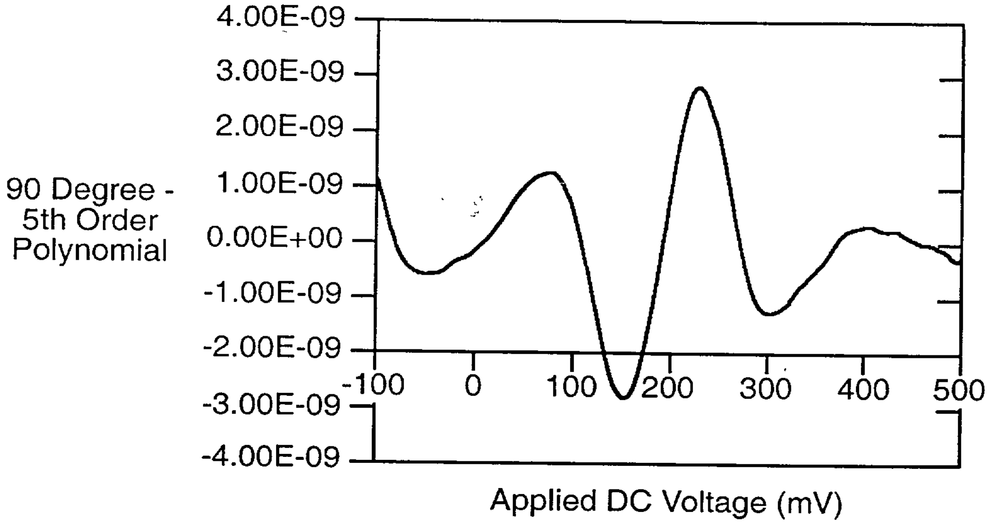

4.00E-09
3.00E-09
2.00E-09
1.00E-09
0.00E+00
-1.00E-09
-2.00E-09
-3.00E-09
-4.00E-09
90 Degree -
5th Order
Polynomial
-100
0
100
200
300
400
500
Applied DC Voltage (mV)

FIG._45

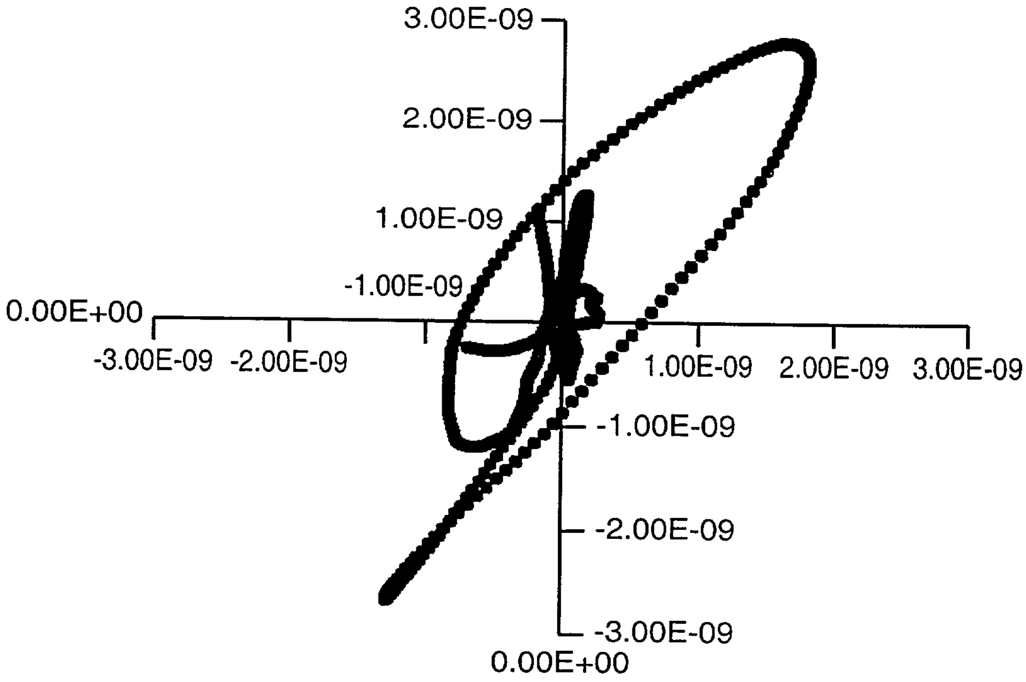

3.00E-09
2.00E-09
1.00E-09
-1.00E-09
0.00E+00
-3.00E-09
-2.00E-09
1.00E-09
2.00E-09
3.00E-09
-1.00E-09
-2.00E-09
-3.00E-09
0.00E+00

FIG._46

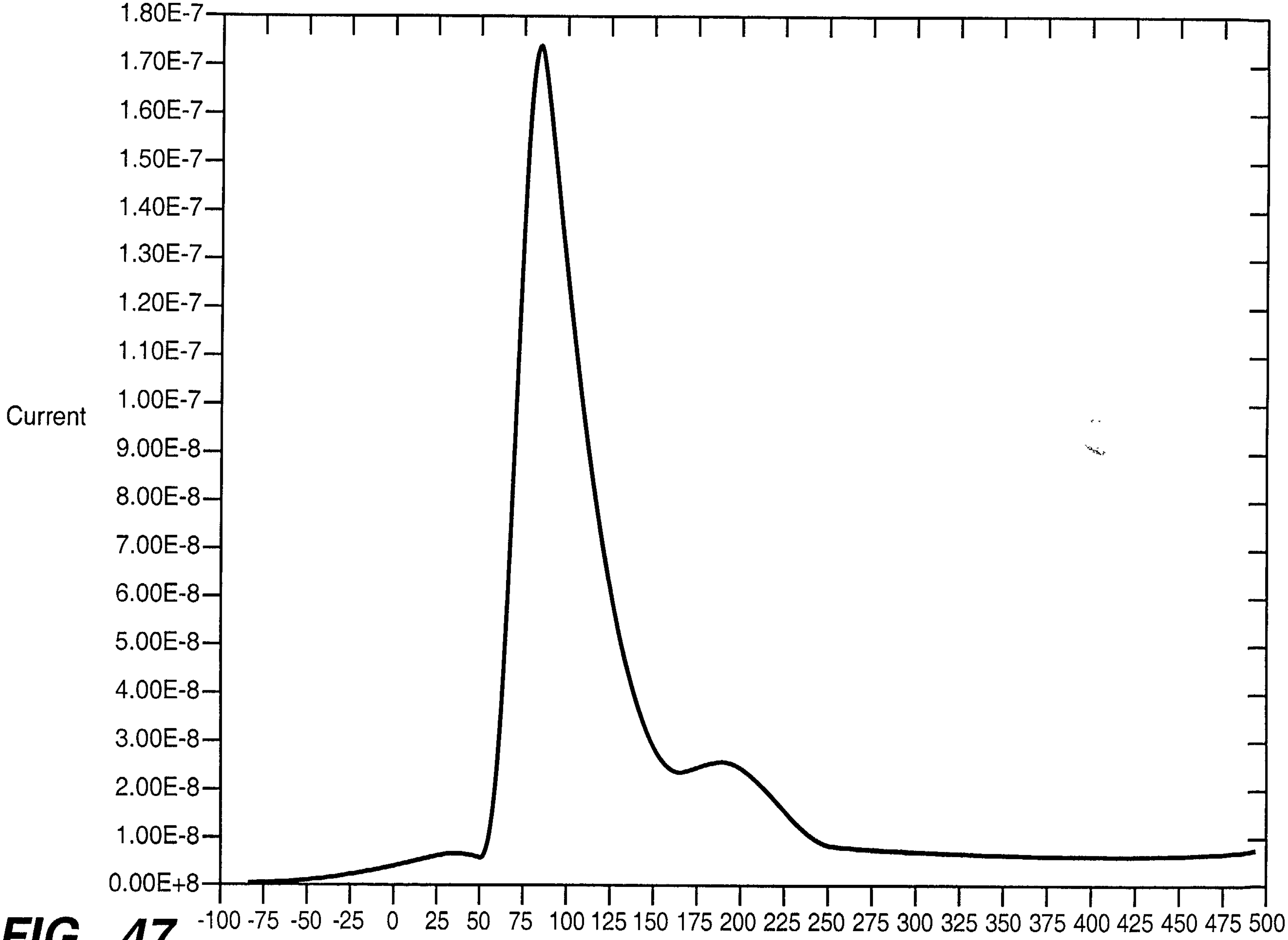

Current
1.80E-7
1.70E-7
1.60E-7
1.50E-7
1.40E-7
1.30E-7
1.20E-7
1.10E-7
1.00E-7
9.00E-8
8.00E-8
7.00E-8
6.00E-8
5.00E-8
4.00E-8
3.00E-8
2.00E-8
1.00E-8
0.00E+8
-100
-75
-50
-25
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500

FIG._47

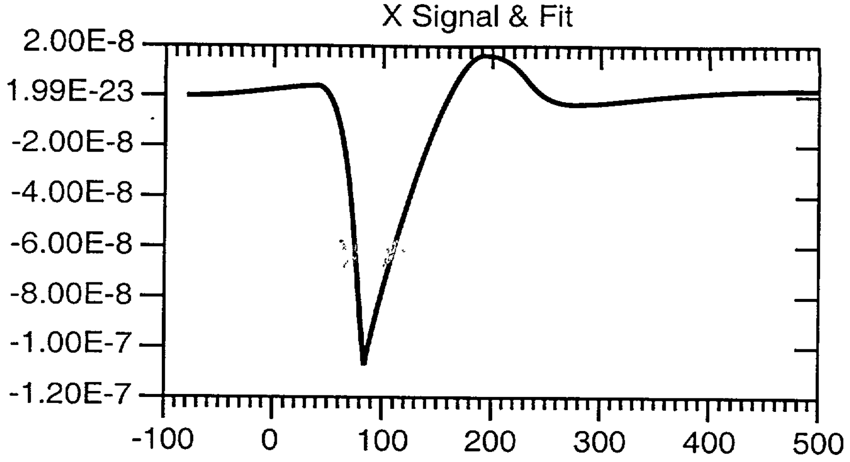


FIG._48

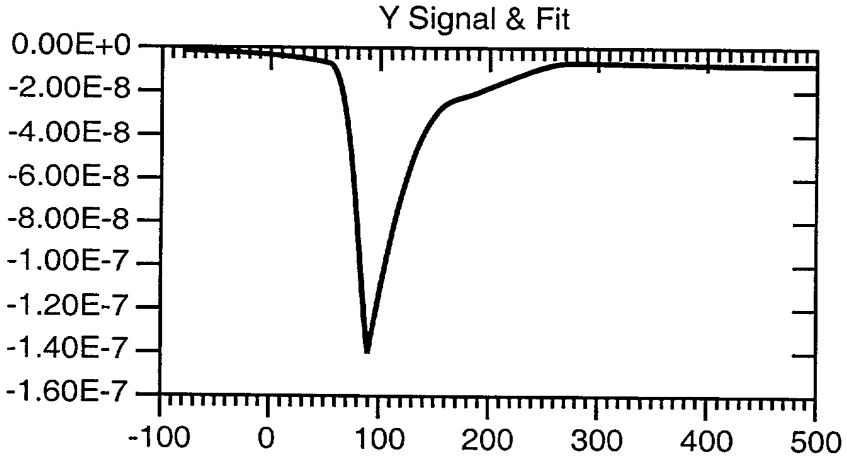


FIG._49

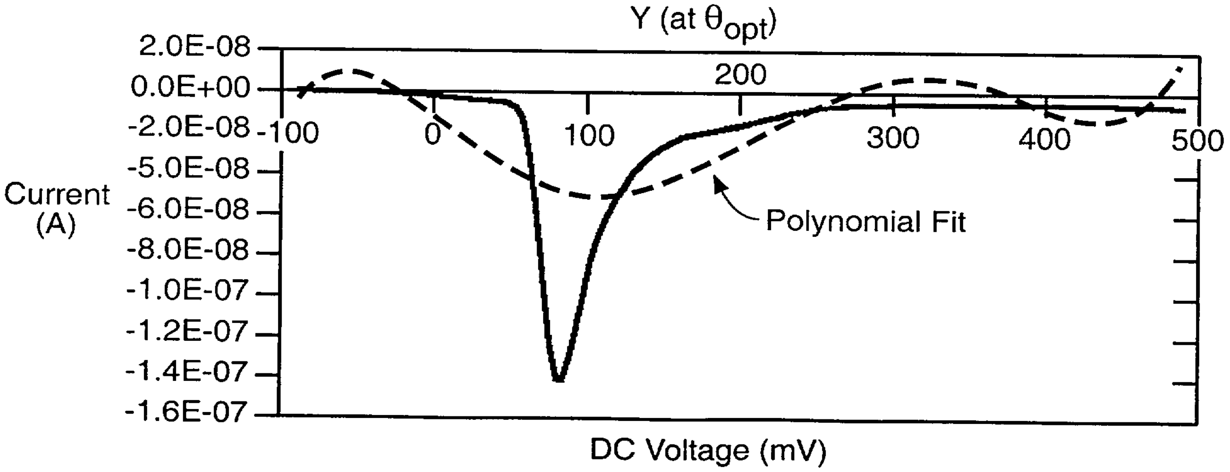


FIG._50

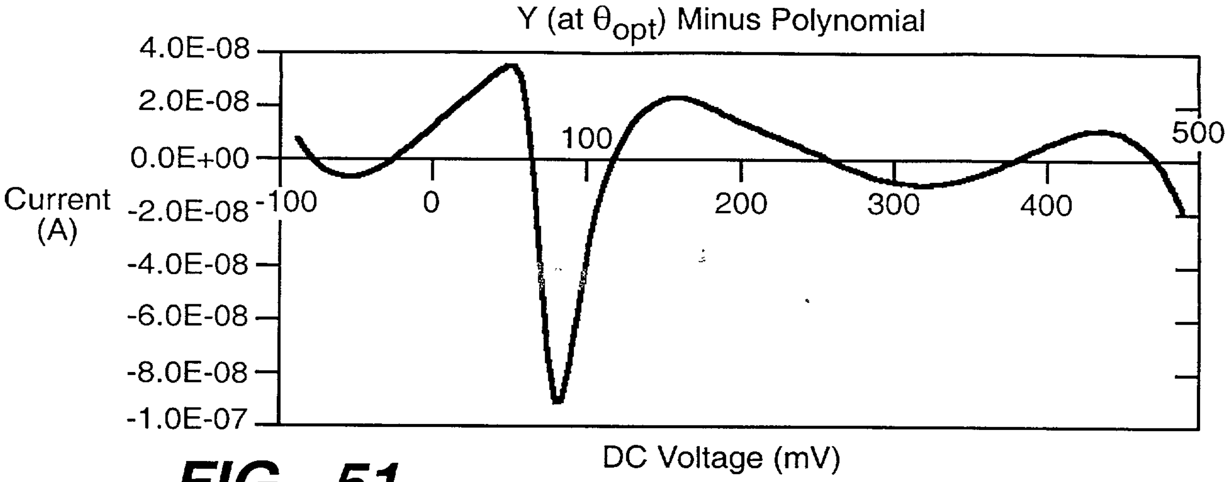

Y (at θ_{opt}) Minus Polynomial
4.0E-08
2.0E-08
0.0E+00
-2.0E-08
-4.0E-08
-6.0E-08
-8.0E-08
-1.0E-07
Current
(A)
-100
0
100
200
300
400
500
DC Voltage (mV)

FIG._51

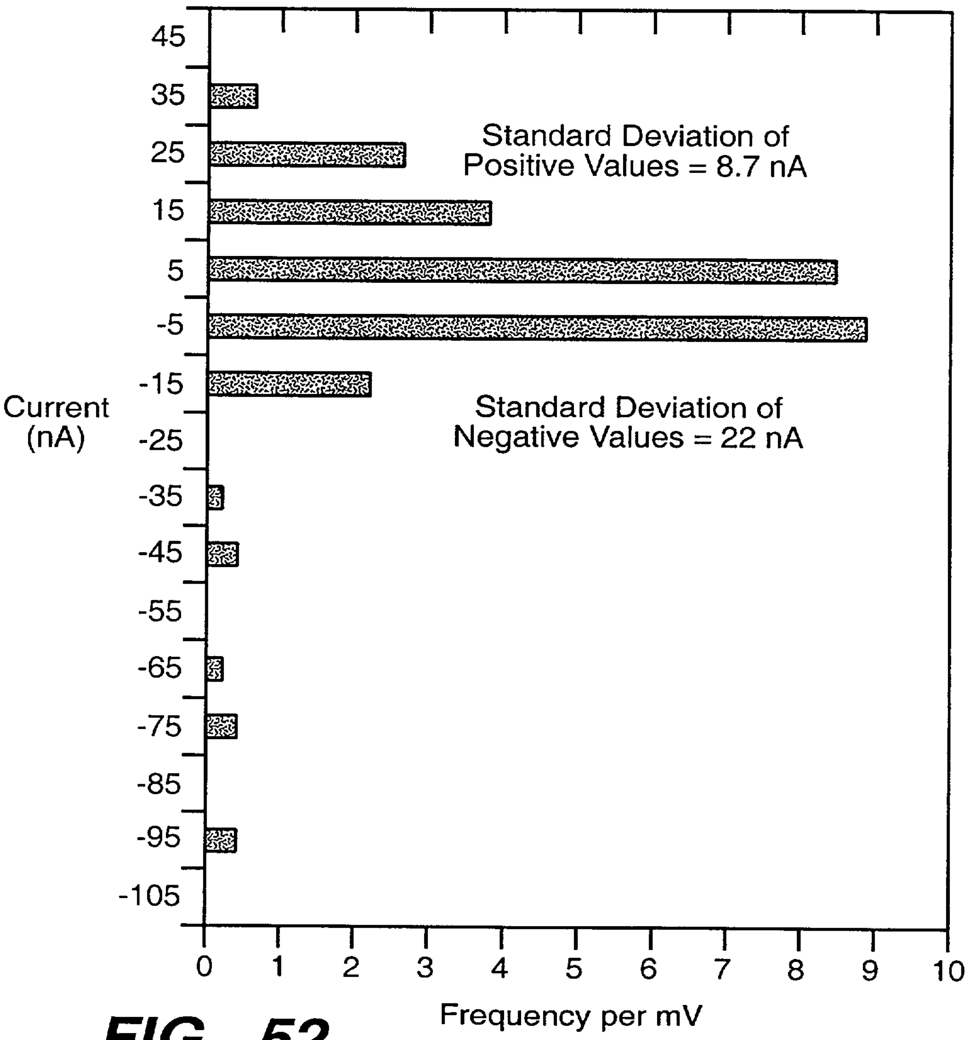

45
35
25
15
5
-5
-15
-25
-35
-45
-55
-65
-75
-85
-95
-105
Current
(nA)
Standard Deviation of
Positive Values = 8.7 nA
Standard Deviation of
Negative Values = 22 nA
0
1
2
3
4
5
6
7
8
9
10
Frequency per mV

FIG._52

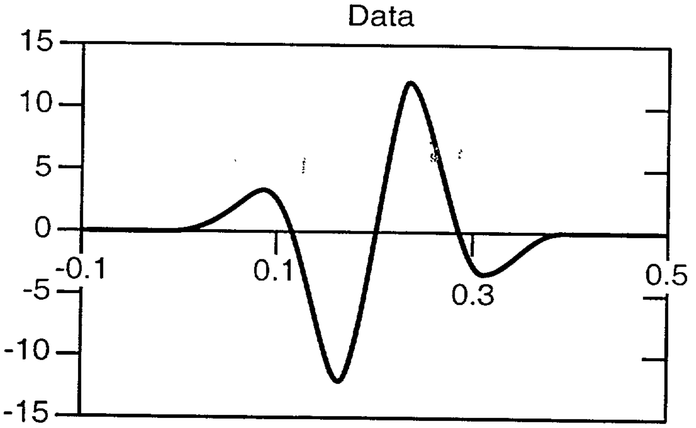

Data
15
10
5
0
-5
-10
-15
-0.1
0.1
0.3
0.5

FIG._53

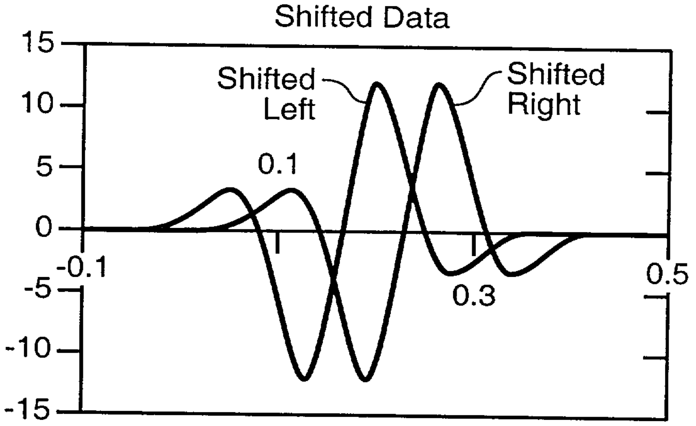

Shifted Data
15
10
5
0
-5
-10
-15
Shifted Left
Shifted Right
0.1
-0.1
0.3
0.5

FIG._54

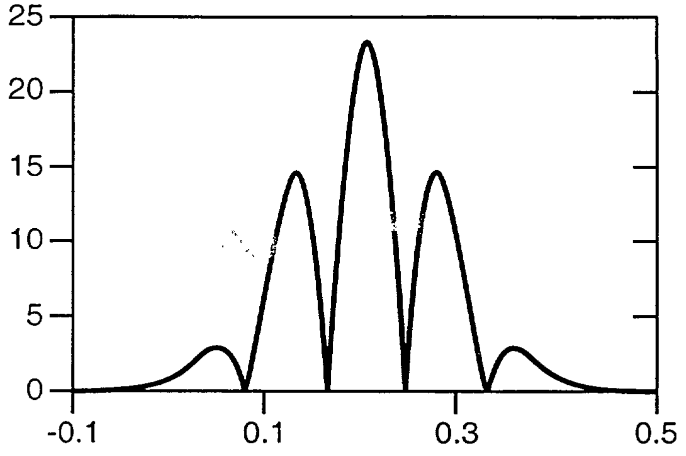


FIG._55

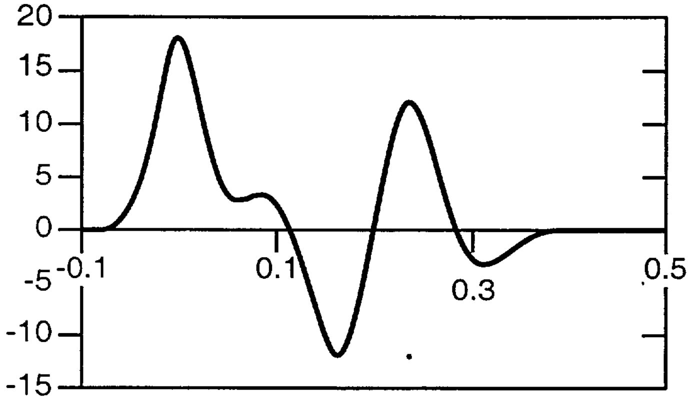


FIG._56

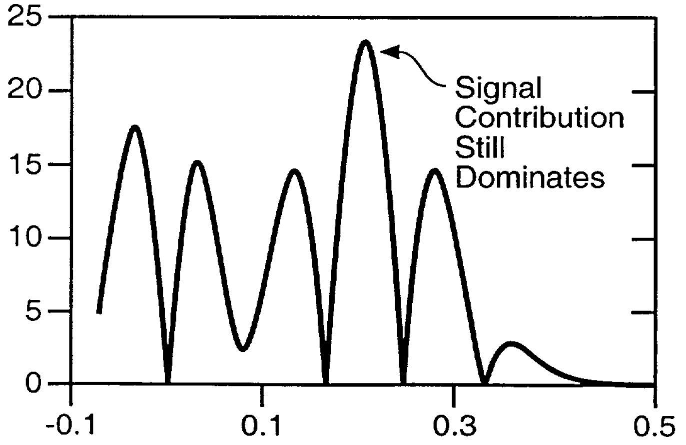


FIG._57

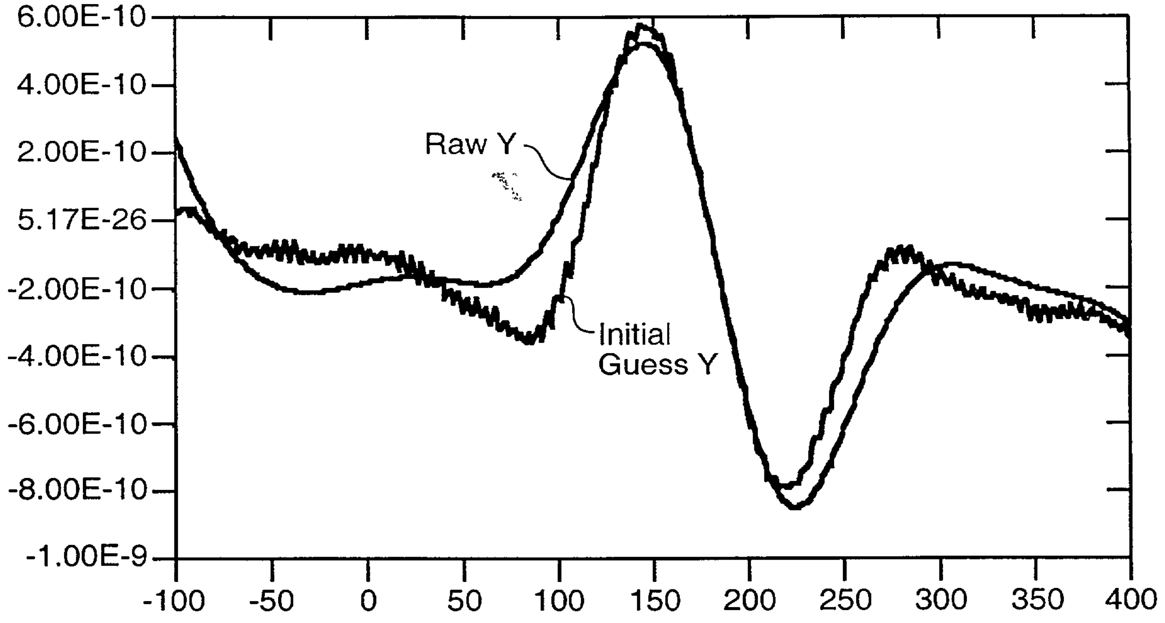

6.00E-10
4.00E-10
2.00E-10
5.17E-26
-2.00E-10
-4.00E-10
-6.00E-10
-8.00E-10
-1.00E-9
-100
-50
0
50
100
150
200
250
300
350
400
Raw Y
Initial Guess Y

FIG._58

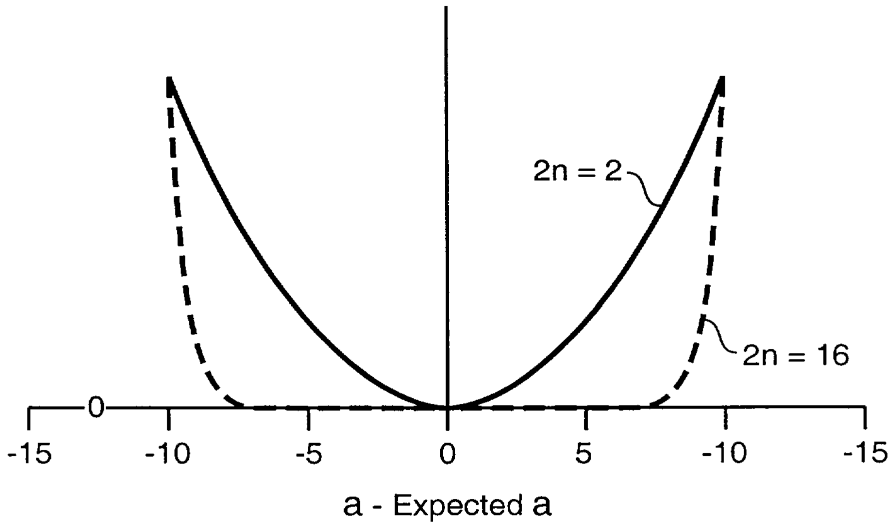

2n = 2
2n = 16
0
-15
-10
-5
0
5
-10
-15
a - Expected a

FIG._59

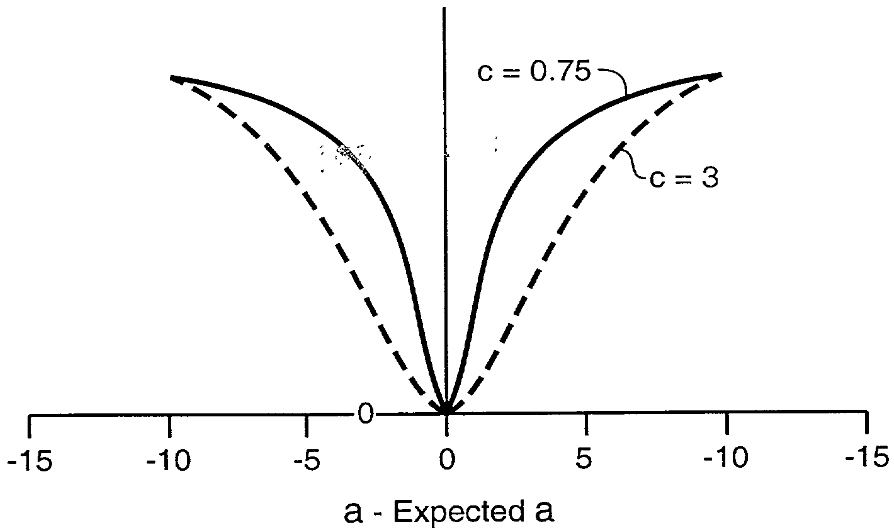

c = 0.75
c = 3
0
-15
-10
-5
0
5
-10
-15
a - Expected a

FIG._60

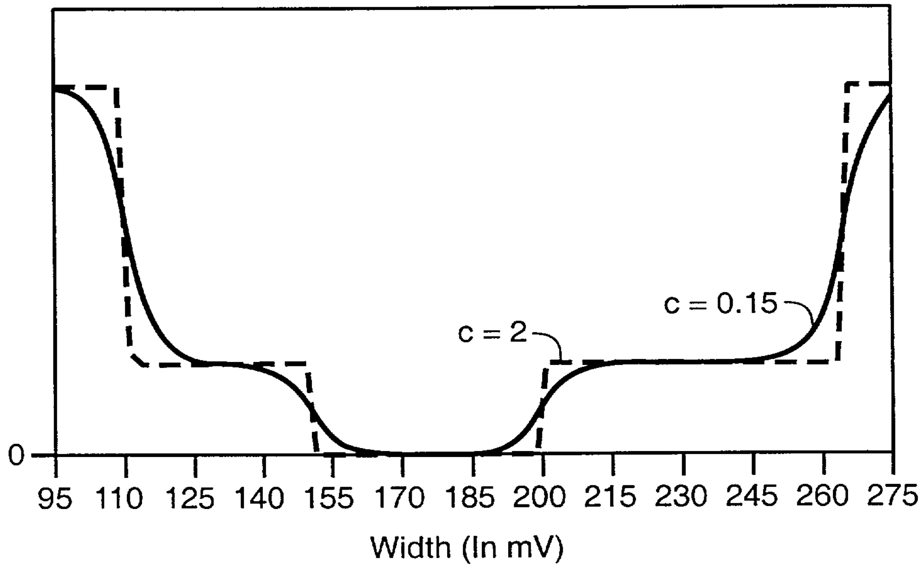

c = 0.15
c = 2
0
95
110
125
140
155
170
185
200
215
230
245
260
275
Width (In mV)

FIG._61

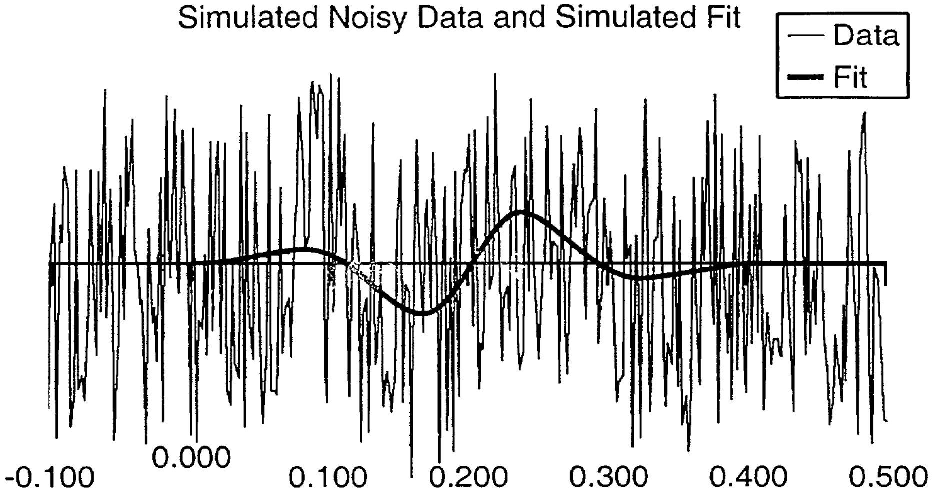


FIG._62

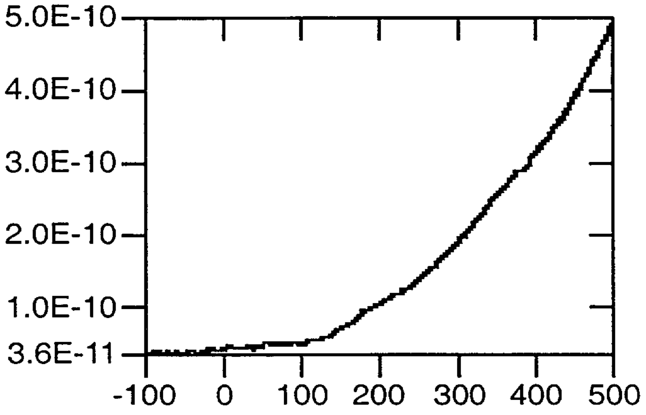


FIG._63

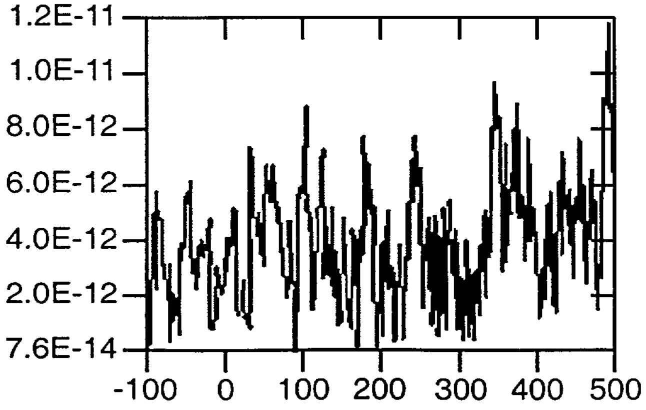


FIG._64

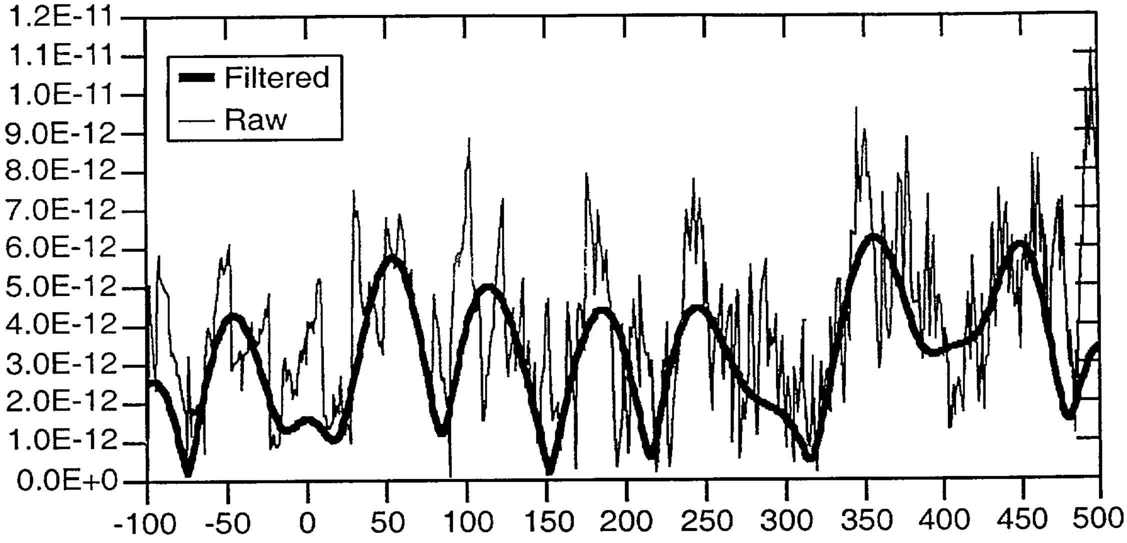


FIG._65

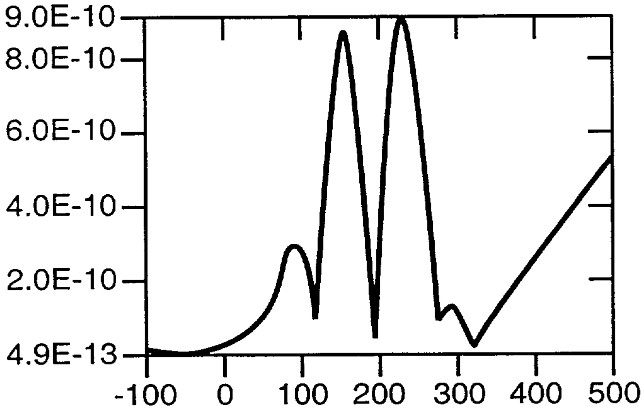


FIG._66

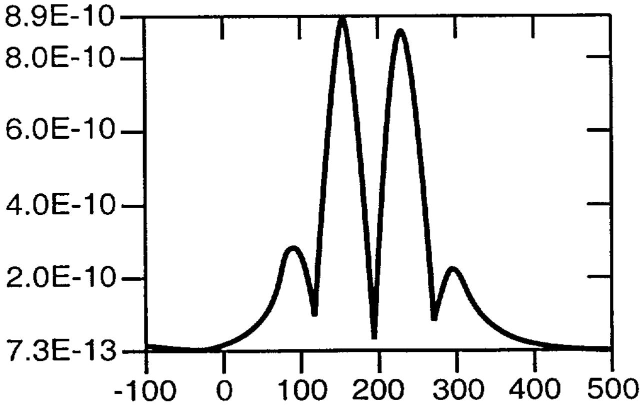


FIG._67

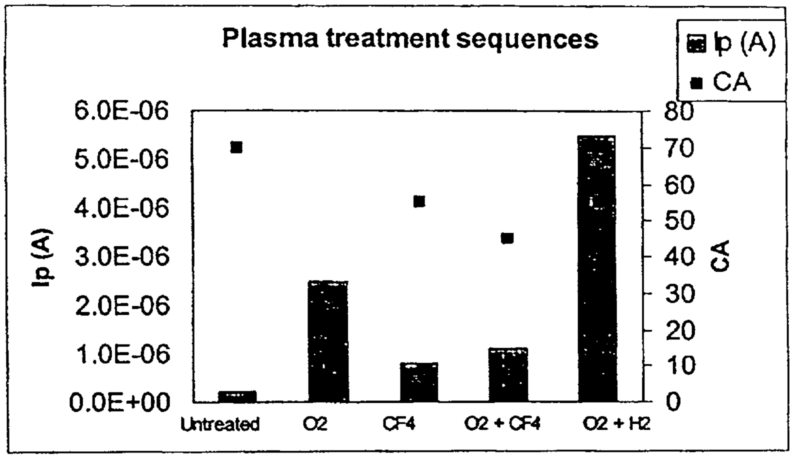

Plasma treatment sequences
Ip (A)
CA
6.0E-06
5.0E-06
4.0E-06
3.0E-06
2.0E-06
1.0E-06
0.0E+00
80
70
60
50
40
30
20
10
0
Untreated
O2
CF4
O2 + CF4
O2 + H2

Fig. 68

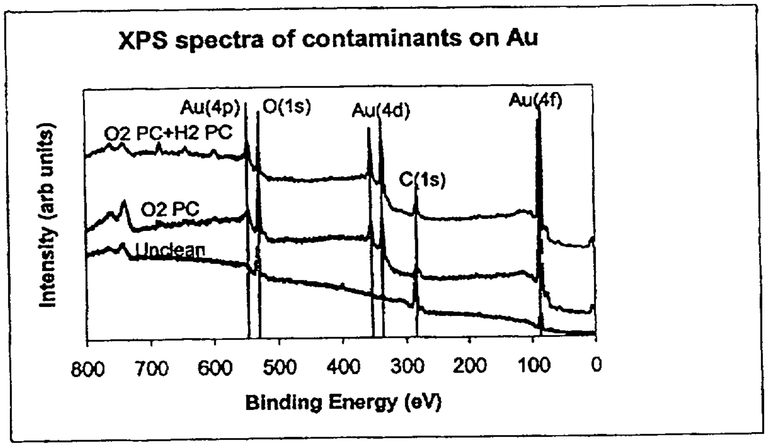

XPS spectra of contaminants on Au
Intensity (arb units)
Au(4p)
O(1s)
Au(4d)
Au(4f)
C(1s)
O2 PC+H2 PC
O2 PC
Unclean
800
700
600
500
400
300
200
100
0
Binding Energy (eV)

Fig 69